ELECTRICAL REVIEW

[ILLUSTRATED.]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

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New Designs in Electroliers.

As the many desirable features of the electric light become known to the public, the demand for new and beautiful devices for displaying this illuminant is constantly increasing. No truer index to this desire of the public can be found than in the large exhibition rooms of Mitchell, Vance & Co., on Broadway, where are to be seen the latest designs and improvements in electroliers, brackets and pendants in which the ornamental and useful happily blend. This firm, organized in 1854, has been a successful student of the wants of the people, and has kept abreast of the times in their manufactory and are now compelled to enlarge their department in which is exhibited appliances for use in incandescent lighting. They manufacture for all the incandescent systems of the country, and some of their new electroliers, as our illustrations will show, are models of beauty and utility. Much of the variety that is shown in the application of the electric light is the result of the artistic and original work of this firm, which keeps constantly employed a large corps of designers and draftsmen who are devoting a great deal of time to bringing out new designs and combinations in electroliers. In the many contracts that are secured by this company, an effort is always made to furnish new styles, and furnish each patron an original and special design. In many of the residences of the wealthy are to be seen evidences of this, one of the more recent collections being that now being put in the residence of Mr. Potter Palmer, of Chicago, in which no pains or expense was spared in making the work ornamental and artistic in the highest degree. The demand, however, is not confined alone to the rich, but all styles, from the cheapest bracket to the most expensive electrolier are marketable, corresponding with all kinds of gas fixtures. The least ornamental, yet durable, are the appliances for mill work, and in this branch the demand is very large and rapidly increasing. All the Government buildings are being fitted up with the electric light, and where formerly the demand was for iron fixtures, now all brass work is required. The contract for furnishing fixtures for the Cincinnati post-office, is one of the later ones secured by this firm. Probably the best lighted room to be seen anywhere is the Senate chamber at Albany, in which the splendid work of this company, combined with the excellent light of the United States Electric Light Company, is a thing of beauty and a joy forever to the hard-working solons. The large electroliers and reflectors have, in this case, not only improved the hall in point of light and ventilation, but have made a decided change for the better in the acoustic facilities of the Senate chamber, much to the satisfaction of our State orators. In the city of New York all the leading clubs are being lighted by the electric light, and in these the artistic work of this firm is conspicuous. Among their later work are the appliances put in for the Hamilton Club, of Brooklyn, also at Delmonico's, the Buckingham, and the Century Club, in which the efforts to create an attractive effect were particularly successful.

On the occasion of the National Electric Light Convention, in this city, in August, a very satisfactory hour could be spent in visiting the exhibition rooms of this firm, located at 838 Broadway, where all the latest designs will be displayed. A new and quite expensive catalogue is now being published by this firm, illustrating this branch of their business exclusively, and a limited number of these will be sent to dealers and agents.

ELECTROLIER—DESIGNED BY MITCHELL, VANCE & CO., OF NEW YORK, FOR THE ROYAL INSURANCE CO. OF CHICAGO.

The catalogues are very complete, and contain numerous illustrations of the splendid work being done by this firm.

The illustrations in the REVIEW are of designs placed in insurance buildings in Chicago, and the rivalry between the various companies, each desiring the latest and most beautiful design, gave Mitchell, Vance & Co., excellent opportunity to show what they could do, and they have fully equaled the expectations of their patrons. Chicago is a splendid field for this work, the many new buildings there, in nearly every instance, being supplied with the electric light.

The cottage piazza, the parlor and the sick room, where Gen. Grant is staying at Mount McGregor, will henceforth be illuminated by electricity.

Report of the Examiners on Carbons for Electric Lamps, International Electrical Exhibition.

Prof. M. B. Snyder, Chairman of Board of Examiners, International Electrical Exhibition:

With the permission of Professor Anthony, Chairman of Group B, I herewith submit separately the report of Section VI., "On Carbons for Arc Lamps." It includes chemical analyses by Dr. Dudley, Professor Green and the chairman, a thorough series of specific gravity determinations by A. E. Outerbridge, Jr., a microscopical study of their transverse sections by Dr. Persifor Frazer, and a table of resistances of the carbons, both plain and copper-coated, made by Professor William A. Anthony.

Respectfully,
SAMUEL P. SADTLER,
Chairman of Section VI.

CHAS. B. DUDLEY,
Secretary of Section VI.

Philadelphia, 1885.

Section VI. had submitted to it for inspection and report the carbons from five exhibitors, viz.:

1. The Brush Electric Company.
2. The Wallace Carbon Company.
3. The Boulton Carbon Company.
4. The Buffalo Carbon Company.
5. The Carre carbons, manufactured by Emile Levy, Paris, and exhibited by Messrs. J. W. Queen & Co.

Of these, the Brush, Wallace and Boulton companies submitted plain and copper-coated carbons, the Buffalo Company a homogeneous carbon, both plain and copper-coated, and, in addition, a carbon with a core of pure graphite inserted in a sheathing of coke and a carbon with a vitrified coating, while Queen & Co. offered only the uncoated Carre carbons.

It was determined to have chemical, physical and mechanical studies made of these carbons, but the study of the physical characters, resistance, duration of burning in the lamp under different conditions of current, etc., was handed over to the Section on Arc Lights, whose chairman, Professor William A. Anthony, agreed to take this part of the work.

The chemical and mechanical study was apportioned out among the members of the section who now present this report, and included determinations of the percentage of carbon, hydrogen and ash, with a qualitative examination of the chief constituents of the latter in the several plain or uncoated samples, the amount of copper on the coated carbons, both absolutely by weight and relatively per unit of length; specific gravity determinations on the uncoated carbons, both with sections of the solid carbons of given length and with the pulverized material; and, lastly, a microscopical study of the structure of the carbon pencils, using for this purpose specially prepared thin cross-sections. The aid of micro-photography has also been availed of in this latter case for the proper illustration of the results.

1. *Determination of the percentage composition of the uncoated carbon* (carbon, hydrogen and ash)—This was undertaken by Professor Samuel P. Sadtler, and was made to include five samples, viz., the plain Brush, Wallace and Boulton carbons, the plain solid Buffalo carbon and the Carre carbon. The Buffalo carbon with the graphite core was not analyzed, as the agent of the company said that the sheathing was made exactly of the same materials and by the same methods as the solid carbon exhibited, while the pure graphite core had a sufficiently well-known composition.

The greater part of a single pencil having been reduced to fine power, the material for analysis was taken from this stock. The determinations were made by the methods of ultimate analysis, using an open tube, three-fourths filled with granular cupric oxide, placing the weighed material in a platinum boat, and conducting over this a slow stream of oxygen. In this way, besides the carbon and hydrogen determinations, the ash could be accurately weighed, and a check established upon the whole.

The results were as follows:

	Brush Carbons.			*Buffalo Carbons.*		
	I.	II.	Average.	I.	II.	Average
Carbon.....	97.61	97.81	97.71	95.92	....	95.92
Hydrogen....	1.32	1.22	1.27	1.15	0.97	1.06
Ash.....	0.64	0.61	0.63	2.94	2.80	2.87
Occluded air or loss.....	0.43	0.36	0.39	....		0.15
	100.00	100.00	100.00	100.01		100.00

	Boulton Carbons.			*Buffalo Carbons.*		
	I.	II.	Average.	I.	II.	Average
Carbon.....	98.19	98.24	98.21	97.68	....	97.68
Hydrogen....	0.72	....	0.72	1.51	1.60	1.55
Ash.....	0.87	0.88	0.87½	1.09	1.08	1.09
Occluded air or loss.....	0.22		0 19	....		....
	100.00	99 12	99.92	100.28		100.32

	Carre Carbons.		
	I.	II.	Average
Carbon.....	95.98	95.84	95.91
Hydrogen.....	1.00	0.73	0.86
Ash.....	1.91	1.83	1.87
Occluded air or loss.....	1 11	1.60	1.36
	100.00	100.00	100.00

In looking at these figures, several points of interest at once present themselves.

The Brush carbons have the smallest ash of the series. On account of their rather more open and porous structure, there is room for occluded air in this case, as the result shows.

The Wallace carbons have the largest amount of ash of the series. The character of this ash will be noted farther on by another member of the committee. This carbon is closer in structure than the Brush carbon, being made in an entirely different way, and there is no occluded air to look for.

The Boulton carbons, though having a higher percentage of ash than the Brush carbons, have a higher carbon and a lower hydrogen percentage, possibly having been burned at a higher temperature.

The Buffalo carbons show a distinctly higher percentage of ash than the Brush or the Boulton carbons. The hydrogen percentage, as given, is possibly a little too high, as the summing up seems to show.

The Carre carbons show a large ash, although considerably less than the Wallace carbons. The porous structure of these hydrocarbons offers, no doubt, a partial explanation for the relatively large percentage of occluded air and loss.

2. *Determination of the percentage of ash and qualitative examination of same.*—This was undertaken by Dr. Charles B. Dudley, and the examination was made upon a portion of the same pulverized material as that used by Prof. Sadtler in the combustion analyses. The results were as follows:

Sample.	Length of coating.	Copper on length of 4 c. m.	Copper per centimeter.	Total copper (not including that on end).
Brush carbon.....	281 millimeters.	.1621 grammes.	.040525 grammes.	1.1386 grammes.
Wallace carbon.....	297 "	.0180 "	.00 "	0.1357 "
Boulton carbon.....	272 "	.1853 "	.046325 "	1.2600 "
Buffalo solid carbon.	262 "	.1010 "	.02525 "	0.6616 "
Buffalo core carbon.	253 "	.1525 "	.038125 "	0 9645 "

The Brush carbons yielded 0.478 per cent. of ash. A qualitative examination showed that the portion insoluble in acids was slight; that there was a considerable amount of ferric oxyde and a trace of magnesia.

The Wallace carbons yielded 2.672 per cent. of ash. A qualitative examination showed a large insoluble residue and a large amount of the oxydes of copper and iron.

The Boulton carbons yielded 0.892 per cent. of ash. A qualitative examination showed a small insoluble residue only, a large mount of ferric oxyde and a trace of maganesia.

The Buffalo carbons yielded 1.104 per cent. of ash. A qualitative examination showed a small insoluble residue, much ferric oxyde and a trace of magnesia.

The Carre carbons yielded 2.086 per cent. of ash. A qualitative examination showed considerable insoluble residue, much ferric oxyde, and considerable lime.

It will be seen that these ash determinations correspond quite generally, in some cases with great exactness, to those gotten in connection with the combustion analyses of the carbons.

3. *Determinations of copper on the copper-coated carbons.*—These were made, by Prof. Wm. H. Greene, upon the samples of the Brush Company, the Wallace Company, the Boulton Company, and both the homogeneous and the graphite-core carbon of the Buffalo Company. No copper-coated sample of the Carre carbon was exhibited.

4. *Specific gravity determinations.*—These were undertaken by A. E. Outerbridge, Jr., and were made upon the uncoated carbons of the Brush, Wallace and Boulton Companies, the French Carre carbon and the plain, the graphite-core and a glazed carbon of the Buffalo Company.

A superficial examination of these carbons showed that some of them were much more porous and of coarser grain than others; it was thought advisable, therefore, to make two different determinations of each sample, one for the purpose of ascertaining the specific gravity of the pencil, and the other the specific gravity of the material of which the pencil is composed.

ELECTROLIER, DESIGNED FOR THE HOME INSURANCE COMPANY, OF CHICAGO.

For the first method the samples were all cut to the same length, viz., 5 centimeters. These were first heated to a moderate temperature to expel the moisture absorbed in their pores and further dried in a desiccator; when quite cool they were weighed upon a delicate analytical balance, sensitive to less than one-tenth of a milligram. The pencil was then coated with shellac varnish to prevent the absorption of water when immersed. When the thin coating of shellac was hard the sample was suspended from the beam by a filament of silk and reweighed; this was the weight used in the specific gravity determinations. The sample was then immersed in a beaker glass of distilled water at 60° F. and weighed. The specific gravity of the pencil was then determined by the usual calculation.

In order to determine the specific gravity of the material of which the pencils are composed, it was first ground to a fine powder in a steel mortar, put through a "No. 80" sieve, warmed to expel moisture, dried in the desiccator and weighed. The weight taken in this case was usually two-grammes. The specific gravity bottle which was used in these determinations was filled each time with distilled water at, or very near, 60° F., and weighed; the water was then poured out, the powder put in, the bottle refilled with water (care being taken that no air-bubbles remained) and reweighed, from which data the specific gravity of the sample was determined.

In addition to the above, two other experiments were made, as follows: The pencil was broken up in the mortar and the finest particles separated by the sieve; the coarser grains were weighed, thrown into distilled water and boiled. The water was then cooled down to 60° F., the granules transferred to the specific gravity bottle and a new determination made. In both cases, the specific gravity was much higher than that of the finely powdered portion of the same sample, as will be seen from the tubular statement appended. This would seem to indicate that some volatile gas was driven off during the process of boiling.

A further observation was made, viz: that the material composing the pencils is not of uniform density. When the sample is finely powdered, thrown into water and stirred with a glass rod, a portion sinks, but another portion (somewhat like an oily scum) floats upon the surface. This is doubtless some pitch or tar compound used to cement the materials together. Most of the carbons used in actual practice are coated with a superficial layer of copper, and as this would render specific gravity determinations of no value, the plain carbons only were used with the exception of one sample exhibited by the Buffalo Company, covered with a coating of borate of lead. There was also a carbon pencil examined having the peculiarity of a central core (resembling graphite) a little larger in diameter than the core of an ordinary lead pencil.

It was noticed when these different determinations were tabulated that the specific gravity of the powdered carbon was (as might be expected) in each case greater than that of the pencil, and furthermore that the pencils showing the highest specific gravities were not made from the densest materials. Considerable difference was also noticed in the hardness of the different samples.

The figures given in these tables are the average of two weighings of the same sample after drying.

Carbon Pencils.

Name of Sample.	Length.	Weight.	Specific Gravity.
Brush.....	5 cent.	7.8035 gram.	1 526
Wallace.....	do.	8.5667 "	1.571
Boulton.....	do.	7.7162 "	1.516
Buffalo—plain.....	do.	7.7272 "	1.523
Buffalo — graphite core.....	do	7.0540 "	1.415
Buffalo—vitrified..	do.	8.5961 "	1.598
Carre.....	do.	8.6091 "	1.506

Ground Carbon.

Name of Sample.	Weight.	Specific Gravity.
Brush.....	2 grammes.	1.587
Wallace.....	do.	1.606
Boulton.....	do.	1.602–1.540 Average, 1.573
Buffalo — graphite core.....	do.	center core, 1.699 / exterior, 1.594
Buffalo—vitrified..	do.	1.865
Carre.....	do.	1.885–1.914 Average, 1.8995

Secondary Batteries.*

BY FRANK GEERE HOWARD, Stud. Inst. C.E.

The earliest form of accumulator was a voltameter worked backwards, and was first observed in 1801 by the French chemist, Gautherot. Two years later, Ritter, in Germany, carried out a number of experiments in the same direction, and endeavored to utilize the reaction; he employed for this purpose two plates of gold, separated from each other by flannel kept moistened with acid, and charged by an ordinary Volta's pile. If two pieces of platinum be immersed in dilute sulphuric acid and connected to the two poles of a battery, so that a current be sent through them, the liquid will be decomposed, hydrogen being given off at one plate, and oxygen at the other. If then the battery is disconnected and the plates circuited through a galvanometer, it will be seen that they give out a current in the opposite direction to the charging current.

Becquerel first pointed out the real cause of the returned current, upsetting the original theory that the plates absorbed the current during the charging, and gave it up again during the discharge. He showed that the returned current was not due to the storage of electricity, but to the presence of substances having chemical affinities for each other, derived from the decomposition going on during the charge.

If two sheets of ordinary lead be placed in dilute sulphuric acid, and a current be sent through them, a dark brown deposit will form upon the plate connected to the positive pole of the charging battery, due to the formation of the peroxide of lead on the surface of that plate, whilst the other will be reduced slightly to spongy lead. Upon disconnecting these plates from the charging source, and circuiting them through a galvanometer, a current will flow from the brown or peroxidized plate to the other reduced plate,

The result is the reduction of the peroxide of lead on the one plate to oxide, and then to sulphate of lead from the presence of the sulphuric acid in the solution; and of the spongy lead to sulphate of lead. Upon re charging, the anode or brown plate, attached to the positive pole of the charging source, will again become peroxidized, and the cathode or other plate reduced to spongy lead. The sulphate of lead will thus disappear from both plates. The plates are thus continually oxidized and deoxidized as they are charged and discharged. This is a secondary battery in its simplest form, and all accumulators are based upon this principle. Lead has proved by far the best metal for the purpose, because it forms an almost insoluble oxide; a few other metals are nearly insoluble, but lead has the advantage. It is better than silver or manganese, for the reason that its oxide is less soluble than either of them.

The initial electromotive force of a freshly prepared cell when charged is 2.25 volts, but this drops after the first few minutes of the discharge to a little less than 2 volts,

* This communication was read and discussed at a meeting of the students of the Institution of Civil Engineers on the 16th of January, 1885.

which may be taken as the normal electromotive force of a cell made up of peroxide of lead, spongy lead and dilute sulphuric acid. The constancy of the electromotive force of a cell varies considerably with the rate of discharge. It is run down, or discharged, at a very rapid rate, it falls off very quickly; whereas, if only a small current be taken out the electromotive force will remain constant for a long time, though the loss on the negative plate or anode from local action will be greater. The strength of the electrolyte or solution varies considerably during the charging or discharging of the cell. When the cell is fully charged the solution is strongest, and when discharged weakest. From this it follows that the internal resistance of a battery is lowest when the electromotive force is at its highest, and the converse. Dr. Frankland has endeavored to utilize this change in the specific gravity of the solution, to indicate the condition of the cell, and has found that a change of 0.005 in the specific gravity was equal to a storage of 20 ampere hours. This method of determining the state of the cell does not in practice give very good results, on account of the difficulty of getting the solution in the cell to circulate freely, so as to be of the same density throughout.

The first practicable form of accumulator was that of Plante, made in 1860. He took two sheets of lead, and, placing them in dilute sulphuric acid, passed a current through them for some time. Then disconnecting the cell from the charging source, he discharged it, and again charged it, but this time in a reverse direction, so that the lead plate, formerly connected to the positive pole of the charging source, was this time connected to the negative pole. A number of charges and discharges were thus alternately effected until the plates were rendered sufficiently porous to give a satisfactory storage capacity. Plante found that it was necessary to continue this process for some months before a battery was fit for use. Of course, when the battery was used the current was sent through it always in the same direction. The reverse charges were only employed to "form" the plates, or render them sufficiently porous to hold a charge. Unfortunately this form of cell, simple as it is, does not store much electrical energy, except when very thin plates are employed, and these soon become brittle and liable to fall to pieces through being entirely con verted into peroxide of lead and thereby losing their stability.

According to Geraldy, a Plante cell containing 1.445 kilogramme of lead is capable of storing 4,983 kilogrammeters of energy, or 11,329 foot-pounds per lb. of lead. De Meritens modified the Planté cell by making the plates out of a number of thin sheets of lead laid one upon the top of the other, and soldering their edges together, thus obtaining plates composed of a number of layers of thin sheet lead.

Kabath again modified this by taking long thin strips of lead which he corrugated by passing them through grooved rollers, and then interleaving them with plain strips, or ribbons of lead, folding them backwards and forwards, until a plate was formed of the required size. The drawback to this form is that the lead used is of necessity very thin, and thus soon breaks down and renders the cell useless. In both these cases the same tedious process of forming as in the Plante cell has to be gone through.

In 1880 Faure devised the plan of pasting red lead, or minium, upon plates of plain lead; this paste was rapidly peroxidized and reduced in one charge, thus overcoming and doing away with the long process of forming the Planté plates. The paste had to be held on the plates by wrapping them in flannel or some such porous material. This increased the internal resistance of the cell, and after a time the flannel began to get rotten and fall off, causing the cell to fail. A much higher storage capacity, however, was obtained, it being 18,000 foot-pounds per lb. of lead and minium. Many improvements have been introduced by Messrs. Sellon and Volckmar, culminating in the form now manufactured by the Electrical Power and Storage Company, which consists of grids of cast lead with holes from $\frac{1}{4}$ to $\frac{3}{8}$ inch square.

The grid used for the anode is made thicker than that for the cathode. These castings are filled with a paste of minium and dilute sulphuric acid. After being dried they are placed in long troughs, filled with dilute sulphuric acid, and a current is sent through them to form them. The amount of current necessary to convert 1 lb. of minium to peroxide is 70 ampere-hours, and 140 ampere hours to reduce it to metallic lead. But as it only needs 110 ampere hours to reduce 1 lb. of litharge, this is generally employed for the cathode plate. After the current has been sent through the plates, they are taken out, washed, and stacked until required for use, when they are mounted in their respective cells, and employed for lighting or other purposes. No felt is put between these plates; they are separated from each other by India rubber bands, pieces of wood, or some similar device.

The storage capacity of this cell is considerably higher than that of the Faure type, being 48,000 foot-pounds per lb. of lead. But since the storage capacity of a theoretically perfect secondary battery is 360,000 foot-pounds per lb. of lead, even the best cell falls far short of this. The figures in Table I. against Sellon-Volckmar are the results obtained from cells specially constructed for driving electric launches, tramcars, etc. Those employed ordinarily for lighting purposes yield about 36,000 foot-pound per lb. of lead.

ELECTROLIER, DESIGNED FOR THE ROYAL INSURANCE COMPANY, OF CHICAGO, BY MITCHELL, VANCE & CO., OF NEW YORK.

TABLE I.—STORAGE CAPACITY OF THE VARIOUS SECONDARY BATTERIES AS REGARDS RATIO OF WORK TO WEIGHT.

Name.	Storage Capacity in foot-lbs. per lb. of Lead.	Percentage of Efficiency.
Theoretically perfect cell .	360,000	100.00
Sellon-Volckmar.....	48,000	13.13
Crompton-Fitzgerald.....	24,000	6.66
Faure.....	18,000	4 99
Plante.....	12,000	3.33

It has been proposed by Mr. Fitzgerald to substitute carbon for the lead employed for establishing contact with the active material of the cathodes, where oxides of lead are used, and also to protect parts of the anodes by means of some insulating material, so as to arrest the process of peroxidation over the whole of the plates, and thus always to preserve a good contact throughout the anode. A large number of experiments have been carried out in this direction. The best results obtained were from a battery made up of cathodes composed of minium and carbon fragments, held in a punctured lead envelope, and anodes composed of spongy or finely divided lead, also held in a punctured lead envelope, and protected by a network of insulating material, generally known under the name of Prout's glue. This form had a storage capacity of 24,000 foot-pounds per lb. or lead. Messrs. Beaumont and Bigg's battery is made up of plates of compressed spongy lead. The lead is obtained in this state by precipitation from a solution of acetate, or sugar of lead, in which solution is placed a plate of zinc. Lead, in a state of very fine subdivision, is deposited upon the zinc, from which it is scraped off, put into moulds, and subjected to hydraulic pressure. By this means plates of great porosity are obtained, which should have as high a storage capacity as any known form of battery. Of the numerous batteries in the market, nearly all are modifications of the well-known Plante type, which seems to be the best form for durability, if not for storage capacity; and the "life" of a battery is of far more importance than its storage capacity per lb. weight. The most notable battery of this class, and one coming prominently into notice, is manufactured by the Wolverhampton Electric Light Company, called the Elwell-Parker accumulator. The plates of this battery are made of sheet lead only, but before being formed they are immersed in a strong solution of nitric acid, which attacks the surface of the lead, and honeycombs it to a certain extent. Thus, according to Plante, who first patented this process in 1881, the long process of forming is, to a great extent, done away with. There seems, however, to be considerable doubt whether this is the case, or if the nitric acid simply dissolves the lead. In all probability the acid attacks the impurities in the lead, and thus prepares the plate in the best possible manner to receive the current. Another battery is the B.T.K., so called from the names of the inventors, Messrs. Beeman, Taylor and King. This is a modification of the Kabath accumulator, consisting of plates made of alternate corrugated and plain strips of lead, wound round and round upon themselves.

An improvement by Dr. Frankland is claimed upon the Sellon-Volckmar type of battery, by hardening the paste of minium, or other oxide of lead used in the plates, by immersing the plates in solutions of sulphuric acid of various densities during different periods. He also claims for the plates the capacity of receiving a higher rate of charge. This hardening mixture may be cast into plates or cylinders of any desired form or size. There are also many other batteries of the Plante type by various inventors. Mr. Joel has patented a plate having a considerable storage capacity. He makes the plates of lead-wool, or perhaps more properly speaking, lead fiber, mixed with minium, and then pressed upon a cast-lead plate which acts both as a conductor and support.

The advantages of accumulators made after the Plante type, over those of the Faure type, are that they afford a far higher rate of discharge. This property is invaluable for many purposes, as, for instance, where numerous lamps are required to be run for only a short time. But then again accumulators of the Faure type take in a higher rate of charge than the Plante, because they have a greater thickness of working material, and also store a larger amount of electrical energy in a given weight.

The durability, or life, of a secondary battery, has never been satisfactorily settled. Manufacturers assert that their accumulators will last for a number of years, but this has not yet been proved. Those of the Sellon-Volckmar type, cannot, the author believes, be depended upon to last more than five or six months at the outside, when they are worked regularly every day up to their full capacity. But when overcharged continuously or otherwise improperly used, a few days will often suffice to put them out of order.

The Plante accumulator should last longer than this, but it must be borne in mind that when this battery has arrived at its maximum of efficiency, it is on the point of falling to pieces. Where water or steam power is available, a rough, but serviceable battery may be made by taking sheets of thick lead, cutting them into plates of any required size, and mounting them in tanks filled with dilute sulphuric acid. Of course, during the first few charges the storage capacity will be very small, but this will improve every day; at the same time the cost of forming them is next to nothing. Eventually it will prove to be a most efficient battery.

The first and most important point in setting up a secondary battery is to carefully insulate the cells from each other, and from any moisture. This is best effected by arranging them on wooden shelves raised about eight inches off the floor, and at an equal distance from the walls. The boxes should be left with a space of at least an inch between them, and wherever possible placed in single rows and not upon shelves one on the top of the other, so that free access may be had to each box. In large installations the cells are often of considerable size, weighing from 5 to 6 cwt. each, thus rendering it extremely difficult to move them. For these reasons they should be so arranged that, once put up, they can be easily got at for repair without being removed. The importance of keeping the cells perfectly free from moisture can hardly be overrated. If they should be placed upon a damp floor, or in any position where moisture can get to them, there will be a considerable leakage of electricity, the cells will rapidly run down (*i. e.*, become discharged), and will be in all probability condemned as unworkable and useless.

** Dr. Curran writes to the *Lancet* concerning the advantages of using electricity in killing criminals. "It is a pity," he says, "the thing is not tried, if only by way of experiment, on some of our lower congeners, whence it might be transported in time to the higher regions of Newgate and the provinces." This man writes with considerable nerve. "The apparatus," he continues, "of this fluid or force might be packed away in an ordinary traveling trunk."

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Mr. J. Viennot, 150 South Fourth Street, Philadelphia, is our accredited representative for Pennsylvania.

Mr. C. C. Haskins, 118 LaSalle Street, Chicago, Ill. will represent the REVIEW in the West.

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A Cleveland advertiser of a pneumatic door-bell makes an original point in his favor by stating there is "no electricity to attract lightning." The only way to make this statement more convincing would be to claim "no lightning to attract electricity."

The Underground Wire Commissioners of this city, Messrs. Jacob Hess, Theodore Moss and Chas. E. Loew, have assumed the duties of their office. As they are all business men, we hope to see them deal with the problems before them in a practical, business-like manner.

The Viaduct Manufacturing Company, of Baltimore, have in use in their factory the first Brush dynamo ever put together—a small one made by Brush while living on his farm near Cleveland. The machine is used in making magnets, and does its work well. It has been in the possession of its present owners since 1878, and, although Brush has offered to give several times its value, the Viaduct Company decline to part with it.

It is stated that Theo. N. Vail has resigned as general manager of the American Bell Telephone Company. We have not learned the particulars of this important change, and we are very much surprised that it should occur. The splendid success of this great corporation has been mainly due to the marked ability of Mr. Vail's management, and he will be sadly missed by all in the telephone field. Mr. O. E. Madden, the present assistant general manager, will, no doubt, succeed Mr. Vail. The Bell Company has reason to congratulate itself upon having at such a crisis a gentleman of such ripe experience and large executive ability to assume the duties of General Manager, if Mr. Vail has decided to retire for a much needed rest

We learn that several trials of the Edison-Smith-Gilliland induction telegraph system, by which messages can be sent to and from moving trains, have been made recently at Clifton, Staten Island, each test scoring a pronounced success. The promotors evidently have a valuable invention in this system, the base patent for which was secured several years ago by W. W. Smith and E. T. Gilliland, and which Edison has been working out for two or three months past.

An electric flash has been suggested as a night substitute to the locomotive whistle in compactly-built neighborhoods. Those who suffer from insomnia, and to whom the shrill whistle is a terrible nuisance, will appreciate the idea, and will pray that electricity may yet come to their aid in this matter. With electric fans to furnish cooling breezes, electric lights to furnish light without heat and vitiated atmosphere, electric flashes to supersede ear-splitting whistles, and electric motors with noiseless movements, the resident in the neighborhood gridironed with railways may yet be happy.

An important telephone case was commenced in the United States Circuit Court, Pittsburgh, Monday of this week. The case involves the right of the Bell Telephone Company to hold a monopoly of telephone privileges in the United States. The array of counsel is formidable, embracing, in addition to prominent local talent, several of the leading patent lawyers of the United States. There are also present some of the leading capitalists of New York, New Orleans and Boston, who are interested in the case. Two large tables, covered with every description of electrical apparatus associated with the progress of the telephone, occupy a conspicuous position. J. J. Storrow, of Boston, opened for the Bell Company. He said that they would be able to show conclusively that the defendant's claims had already been disproved in prior suits; that the Bell Company did not lay claim to any particular feature, but to the principle involved, which was that of transmitting speech successfully by electricity. He then cited the already numerous decisions in favor of the Bell Company. The case will probably occupy all week. A visitor to the court room would be in doubt whether he was in a court of justice or a telephone exchange.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

The applications for membership in the National Electric Light Association are being sent in to the President, J. F. Morrison, of Baltimore, in such numbers as to indicate a deep interest in the success of the organization. It is now evident that the attendance at the meeting in this city, August 18th, will be of much larger proportions than was anticipated, and to enable the Executive Committee to satisfactorily arrange for accommodations for delegates, applications should be sent in *at once*, as the time is short. A check of $10, covering admittance fee, payable to the order of Summerfield Baldwin, Treasurer, should accompany each application. No one interested in electric lighting should fail to promptly unite with this Association.

THE NEW UNDERGROUND COMMISSION AND THE PROBLEM BEFORE THEM.

The commission to supervise the carrying out of the law as to the burying of the wires has been appointed.

We said long since that any forcing of the electrical companies in this regard was both unjust and illegal, and since then the law has been changed, so that considerable discretion is allowed the commission. They are permitted to extend the time for laying and to make exceptions in particular cases, such, for instance, as along suburban routes.

They may as well understand now at the commencement that, if they try anything in the way of persecution, they will be served with an injunction restraining them from further interference, and the argument as to the validity of the law may last until Grace has lost all chances of getting the nomination for governor, or, having got it, is defeated, and the political influence through which the commission was appointed lost its potency.

It is left by the new law entirely to the discretion of the commission how far an underground system shall be required, how it shall be devised and applied, and how soon it shall be put in operation. In the law as first placed on the statute books, it was required that all the electrical wires "shall be placed under the surface of the streets, that the corporations owning or controlling the wires, cables, poles and other appurtenances shall remove them from the surface of all streets and avenues by the first of November, 1885, and that in case of their failure to do so, the local government shall then proceed to remove them without delay." But in the law, as amended, it is laid down as the policy and purpose of the act to have "electrical conductors removed from the surface, and placed and operated underground as soon as may be consistent with the convenient use thereof by the public; to cause the wires and cables to be removed from the surface, and put, maintained and operated underground wherever practicable, so that the companies may be enabled and required to transact their business with underground conductors wherever practicable."

Now, here we have something in the guise of sense, and, when it is shown that the telephone wires, at least, will not work properly underground, or that the expense of putting them there will force the rates for service up to so high a figure as to make telephone service almost prohibitory, it will be readily feasible to demonstrate before any intelligent court that keeping them above the ground is entirely within the intent of the law. Writing on the results of carrying out such a law as this, a correspondent says:

"Now that the question of the removal of the electric wires underground has gone into the hands of a commission, it would seem to be in order to discuss the manner of doing this. The removal of these wires to such underground channels as are being used to some extent here and in Chicago is an evil only less in magnitude than that caused by their present position. The tearing up of the streets for the laying and repairs of these conductors, and the regulation of the same by manholes, will add the last straw to the nuisance already caused by the innumerable other underground appliances. These already make it practically impossible to have a decent street pavement (the first condition of which is freedom from piecemeal relaying), and they interfere very seriously with street traffic. It must be borne in mind also that, where water and gas pipes need attention once, electric wires will need it twenty times. Every new set of appliances that goes separately under the street becomes an enemy of change, and the possible union of telegraph, telephone and electric light interests to promote a comprehensive scheme of underground reform is a golden opportunity, the like of which will, in all probability, never occur again.

"If the question were simply to provide in a new street for the introduction simultaneously, or even at considerable intervals, of sewer, water, gas, and steam supply pipes, and for the innumerable electric wires, no one could deny that by far the cheapest plan both for first cost and for operating would be to unite them all in a tunnel large enough to effect repairs at all times, and ventilated and watched so that escape of gas should cause no risk of explosion. The question is, however, whether it will not still be cheaper for New York to rebuild the sewers in the streets where it is necessary to run wires of such sizes as will admit the electric wires and their repair, and also to take in the other underground appliances at the first opportunity that requires the disturbance of the street to get at them. Among the advantages of such an alteration may be enumerated the facility of repairs and the saving of leakage from gas, water, and steam pipes, which now goes on without possibility of detection, except by complicated appliances, to an extent undreamed of except by those engaged in the care of these matters. I would instance the curious fact that the city of Liverpool discovered a year or two ago a water pipe break at which several thousand cubic feet of water per day were flowing into an adjoining sewer, where the indications were that this leakage had been going on for years. The steam companies would be saved from one of the greatest troubles they have to contend with, the drowning of a pipe by water accumulations, and would find their whole problem much simplified where they have not already built their own tunnels. There is further the great saving in cost of paving, in allowing the pavement to remain undisturbed until the whole surface requires renewal, and incidentally the advantage to business of the much better condition in which the pavement could be maintained. The condition of the sewer, which would be an open conduit in the bottom of the tunnel, could always be seen without difficulty and stoppages would be impossible. House connections for gas, water, steam, and electricity could be made by boring from the tunnel or from the house cellar under the street, and by the use of iron house connections even the house sewers could be connected in the same way without ever disturbing the street surface at all."

Most of these objections to the new law have already been urged in these columns, and no one who is familiar with city streets and the cost and disadvantages of tearing them up continually can deny that they are founded on truth. Had we a system of sewers as the Parisians have, the burial of the wires would be comparatively simple, requiring little more than the expense of boring from the houses and offices to the sewer, but even under these circumstances the telephone could not be expected to work as smoothly and clearly as in aerial lines. Speaking further the correspondent, already quoted, says:

"The difficulties in the way of this scheme seem to be, first, the requirement of the law that the removal shall take place by the 1st of November, and secondly, the want of some united influence to bring about the necessary legislation. The former could probably be met by extending the time on the ground that more was required at any rate, and in certain cases of special danger the companies might agree to remove their wires temporarily from the streets to parallel lines across the blocks. The initiative in the matter might well come from the united companies owning wires, who could promote a bill to have sewers enlarged, such bill to state the compensation to be paid by the electric wire companies for the use of the tunnels. The bill might very properly oblige steam and gas companies to remove their pipes to the tunnel whenever it became necessary to uncover them, and fix the rate of compensation to be paid by them for the tunnel use. We would also naturally make it obligatory upon the city to remove its water pipes to the tunnel whenever it became necessary to uncover them, and would regulate the division of expenses for altering private connections of all kinds. If it were not for the provision of the present bill forbidding the grant of a monopoly to a corporation or to individuals for putting the wires under ground it might seem a part o

the duty of the Commissioners to draft such a bill, and so far as everything but the wires is concerned I presume they are at liberty to do so. Possibly they might reach such an agreement with the electric wire companies as would permit them still to do so. In the interests of good pavements, the hope of which seems about to vanish forever, it is devoutly to be wished that some such measure may be taken."

He is not so happy here as when discussing the obstacles in the way of burying the wires. Like the careless traveler he loses his way as he proceeds, and, for fear such notions should spread apace, we will add a corrective to the tail of them, and the readers of the ELECTRICAL REVIEW, who comprise the larger portion of those of the community taking an intelligent interest in the subject, may thus be enabled to take the antidote of explanation with the poison of uninformed and fallacious assertion.

Any general system of sewers like those of Paris would be too expensive for a moment's consideration, and could only be suggested by presuming ignorance. The English Commission who recently studied the subject in Paris reported that these sewers could not cost less than $160,000 for 1,093 yards—and this in England where labor is cheap. To build them in hundreds of miles of New York streets would exhaust the wealth of the Indies, and is not to be thought of.

GENERAL WESTERN NEWS.

On the afternoon of the 27th of June, Chicago was visited by a severe storm, which, fortunately, only struck the southeastern portion of the city with any considerable degree of force. At Cheltenham Beach, however, a short distance south of the limits, where the thunder and lightning were more markedly exhibited, a curious freak was displayed The summer cottage of Mr. Meeker was struck, the current running down the chimney to the kitchen stove. Mr. J. N. Herrick stood near the stove. Lightning jumped from the stove to a steel clasp pocketbook in his trousers, and ran thence downward, tearing off the heel and sole of the shoe on that side, scorching the trouser's leg in its course. Herrick was severely shocked, but recovered after some little time.

Estimates for an electric light plant were recently asked for in a town not a thousand miles from Detroit. Several responses were made by various companies, and these ranged between a little over $3,000 and about $14,000, the specifications in all cases being the same. A difference of, say, $11,000 on the same plant would indicate one of two things: Either some one is in great haste to gather riches, or some one else is sufficiently wealthy, and is anxious to put up lights for their health. Certain it is, however, that in the case mentioned the $3,000 party—if the correspondent who furnishes the item speaks truly—is far better off without the contract, for the work would not be one-half finished with that amount of money. Chicago companies are not in the habit of estimating in that form.

The Baltimore & Ohio Telegraph Company recently asked of the Ohio Valley Telephone Company, at Louisville, the same facilities granted the Western Union for the transfer of messages by telephone. Their wish was refused, and the matter was carried into court. On the 29th ult. the Chancellor made an absolute rule against the telephone company, compelling it to give impartial telephone facilities to the plaintiff.

How true it is that we are sometimes obliged to go abroad to know what is going on at home. A recent foreign journal astonishes us by stating that "In Chicago a portion of the city is still lighted by oil street lamps. It has been the custom of the inhabitants of the district so lighted to take the lamps from their places and consecrate them to personal use, replacing them in the posts in the morning, thus leaving the locality in darkness at night. The Council, in consequence, has arranged with the Louisiana Electric Light and Power Company to replace these lights with 300 arc lamps." How does that strike as something fresh?

The question, "What does o-h-m spell?" is now before the house. Is it *'ome*, or *om*, or *ahm*, giving *a* the sound as in arm? We have all these pronunciations here in Chicago, and one gentleman of limited electrical knowledge, both in theory and practice, will insist on calling it "*a home.*" If we only had some electrical Noah Webster! But, then, we haven't.

Charley Summers, of the Western Union, is an inveterate punster. One of his *bon mots* during the war went the rounds when Grierson raided the State of Mississippi, from Corinth to the Gulf, with a handful of Union cavalry, and cheered the heart of the loyal North. Charley remarked, on hearing of it, that it reminded him of a passage of Scripture, where it says: "Solomon in all his glory was not arrayed like one of these." A few nights since, conversation turned on late and early sleeping hours, when some one remarked that, living in Washington, one seldom retired till eleven, and consequently did not rise early in the morning. Charley remarked that that was contrary to what he had been led to believe. The more 'leven you put in, the earlier would be the rising.

Mr. C. D. Shain, agent here for the Thomas incandescent system, has just made arrangements and had placed at the corner of Sixth and Olive Streets, St. Louis, a lot of 150 candle-power incandescent lamps, in Babcock's cigar emporium, and several adjacent establishments, on the arc circuit of the Brush Electric Light Association. Several of the arc light companies are becoming quite interested in this form of incandescence, which assumes a place intermediate between the arc and incandescent systems proper, and permits of a combination to suit the particular circumstances of each individual case and locality.

The Smoke Inspector has of late been stirring afresh in the matter of the smoke nuisance, at the instance of merchants in the center of the city. Among others, the Sperry Electric Light Company, and J. H. Hapgood of the Mather Company, both of whom have considerable plants, were particularly pointed out as flagrant violators of the ordinance. But the officer was lenient, and ten days' time was allowed in all the cases to permit of the application of the proper remedies.

The Minneapolis Electric Company is about opening up electrical enterprise in the northwest in a way that seems to be practical, and indicative of success. The field properly tributary to Minneapolis is large, thriving, and almost entirely unworked, and with proper business tact, without appreciably diverting any trade from points farther east, should abundantly patronize the new company. The scope of trade proposed embraces every variety of electrical manufacture, the sale of lines, systems, and plants of telegraph, telephone, signal alarms, lightning protection, light, heat and power apparatus, etc., and the purchase and sale of patents for all applications of electricity and magnetism. The company is formed of nineteen stockholders, who evidently mean business. From these the following officers have been selected: President, H. E. Fletcher; vice-president, L. A. Grant; secretary, W. J. Warren; treasurer, C. A. Eaton; general manager, Vernon Bell. The corporation dates from the 1st of the present month.

McVicker's Theater has been refitted during their late rest, and from the magnificent internal chaos, which was presented in twenty-four hours after the last drop of the curtain, has been developed one of the finest samples of inner decoration in the theatrical world. The Western Edison Company have placed in the basement two large dynamos, with most complete engine and other necessary accessories. The entire lighting of the house, stage, dressing rooms, etc., is done by Edison incandescent lamps, divided into groups, all within easy control of the individual whose name, before his present wedding with electricity, was "Gassy," and whose post of honor during business hours is in the flank of "prompt" at the R. F. of the stage. Twelve hundred lights illuminate the building, and these have been so artistically arranged as to beautifully harmonize and blend the decorative effects throughout the whole structure, from the lobby to the back wall of the stage; while on the façade of the beautiful Temple of Thespis, beneath the balcony arches, are suspended three arc lights, which illuminate the outer entrance.

The entire west division of the city is incommoded by a strike of street railway drivers and conductors. At least 20,000 passengers, residents of that portion of the city, are compelled to walk morning and night, or submit to some other inconvenient makeshift to make their daily trips between home and business. The annoyance has set thinking men to work, and serious consultations have been held, looking to the abolishment of the present system of quadrupedal motors, and the substitution of electricity as a "mode of motion," instead. Electrical people are, as a rule, to the fore in novelties, and there are several of these who, ignoring street cars, laugh at the strike and its inconveniences, as they come spinning through the streets to their daily work, on bicycles, tricycles, "sociables," and "rotary-tandems." The Western Electric Company's wheel stables present a quite varied assortment of employes' wheels during working hours.

The Jenny electric system now has representation in Chicago. The panorama of the Siege of Paris, formerly lighted by the Excelsior system, is now illuminated by the former company. Meantime, the new panorama, "The Battle of Shiloh," opposite the exposition building on Michigan Avenue, will be wired at once by Mr. Buckley, their Chicago manager, and illuminated by the Excelsior system.

A belief almost universal, among the rural population of this country no less than elsewhere, is that thunder will addle eggs and kill embryo fowls. So firmly is this fixed in the minds of the farmers' wives, that a thunder storm during the early summer is looked upon as a terrible catastrophe when chickens, ducks, and other poultry are hatching; and it is not infrequently the case that the nests are broken up and replaced with fresh eggs.

In a recent number of a German biological journal, the results of some experiments in this line give a color of veracity to what has often been called stupid superstition.

Professor Maggiorani, according to the journal referred to, arranged to artificially incubate a large number of hen's eggs. These were evenly divided as to numbers, and placed under similar conditions, except that exactly one-half were placed within the influence of a powerful magnet, and remained within its magnetic field through the entire period of incubation.

The result was a very positive indication of the influence of magnetic action. Of those eggs so influenced, there were four times as many which did not hatch as there were in the second lot. The latter group produced an average lot of chickens, which grew normally; while of the first group, out of 114 chickens, over 50 per cent., or sixty, were physically defective in one form or another. Only a half dozen of these arrived at maturity. Among these were two male birds of remarkable height and enormous appetites. Of the four hens which completed the lot, one never laid an egg, and the three remaining hens only produced very small eggs, weighing each less than one troy ounce, and these eggs were incapable of hatching.

From all of which it would appear that the "whim" of the rural housewife may be founded on electrical truths.

Messrs. Woodhouse & Rawson have latterly shown some lamps of the incandescent form, one-half of the globe of which is formed into a reflector by silvering the outside. The solution used for the purpose is a tartarate of silver dissolved in ammonia. The portion of the bulb to be treated is laid in this bath, which is then heated to 18.8° Centigrade, when a brilliant deposit of silver takes place. This is subsequently varnished to protect it from external injury. As the reflecting surface is upon the outside of the lamp, it will not tarnish, it is claimed, except from a deposit on the inner portion. The invention is covered by patents to Messrs. Loraine and Walker.

The seventh multiple switchboard has been ordered for the Kansas City Telephone Exchange.

The Mutual District Messenger Company, of Boston, has declared a dividend of 2 per cent., payable July 6.

The Mo. and Kansas Telephone Company is building a line from Kansas City to Liberty, Mo., a distance of ten miles. No. 12 hard drawn copper wire is used with paper insulators.

The time-ball recently in use at the New Orleans Exposition is now being erected on the Cotton Exchange in that city. It will be connected by wire with the United States Naval Observatory at Washington, and will be dropped by electricity.

The promoters of the newly-invented universal language, "Volopuk," held a meeting lately at Cannstatt. It was shown that the association had made great progress in Wurtemberg and Holland, counted at present upward of 400 members, and had made the first beginning of a "Volopuk literature." The society voted to address the Imperial Telegraph Department for the admission of the Volopuk as an international means of intercommunication.

At Pittsburgh, Pa, on Wednesday last, in the suit of the Bell Telephone Company against the Western Pennsylvania Telephone and Telegraph Company, Judge McKennan, of the United States Circuit Court, granted a preliminary injunction. An offer was made to file a bond and continue business until the final hearing, but the court refused to allow it to be done, saying that as soon as the decree was made work must be suspended. The company has nearly 1,000 telephones in operation.

The number of messages sent over the Western Union wires from its offices in the Western Union building, Broadway, N. Y., on Monday, June 29, was 79,584, compared with 76,436 June 22, and 72,869 Monday, June 30, 1884, 69,909 Monday, July 2, 1883, and 58,780 Monday, July 3, 1882. This looks favorable, but the messages sent out for a month or three months would be more significant of the state of general business, and the net receipts for a like period would show the real effect upon the company.

The friends of Hon. Jacob Hess, Underground Wire Commissioner, have presented him with a pair of climbers, a pair of connectors, and a jack strap, promising that if he became an adept with these, a complete kit of digging tools would promptly follow, so that the honorable commissioner would be fully prepared for the work of putting each individual wire "underneath the ground." Mr. Hess proudly wearing his belt tools, and gracefully astride of a cross-arm on a telephone pole sixty feet above the heads of the wondering and awe stricken multitude, his strong right arm waving aloft his shining insignia of office, a pair of nickel-plated pliers, would be a sight to make other electricians shed tears of envy.

A constable's sale of the effects of the Clay Commercial Telephone Company, used in the operation of the office on the sixth floor of No. 302 Chestnut Street, Philadelphia, has been ordered. The sale is to raise money for rent, amounting to $333.35, which has been due and unpaid by the company. Superintendent F. W. Smith said that the company was in a good position financially, owing not more than $5,000 in the city, but that the directors, in view of the uncertainty of affairs pending the decision of the court in the suit brought by the Bell Co. for alleged infringement of patents, were unwilling to put more money into the concern. The instruments and attachments to be sold are worth, according to Mr. Smith's estimate, nearly $10,000 to the company; but as they could not be used, owing to the Court's restraint, until a decision is rendered, their value is now greatly lowered.

Telephonic News

*** The "Cincinnati Telephone Directory," a neatly-bound volume, of which we have received a copy, is just out for July. It contains the names of 300 towns connected with the Cincinnati Exchange, making one of the best and most extensive toll systems in the United States. Some 2,800 telephone subscribers are named within its covers. Everybody in Cincinnati uses the telephone, and General Manager Geo. N. Stone is to be credited with this excellent state of affairs.

*** The telephone company is building a new line to Lawrenceburg and Aurora, Ind., which will be completed and ready for use in about a week. There are already two lines to these places, but both are of iron, and, on account of the great induction, it is impossible to use the two lines at the same time, as those talking on one line can readily converse with persons talking over the other line, solely by induction. An experiment will be made with one of these lines when the copper line is built. One of the iron wires will be grounded at every fourth pole in hopes that it will collect the escape from the copper wire and the other iron wire, between which it will be placed and carry it to the ground. This is a new theory in electrics, and, if the result is what is expected, a fact will be established that will have an important bearing upon telegraphing.

*** In an action in the Circuit Court at Charleston, S. C., for $5,000 damages against the Southern Bell Telephone Company for cutting the telephone wire of a subscriber during the existence of a contract with the company, the jury found a verdict for the plaintiff for $1 and costs. The Judge charged the jury that under the contract the plaintiff had no right to allow non-subscribers to use his telephone, but the company had no right to cut his wire until it had forbidden such a practice in writing. If the offence continued after such a notice the company had the right to cut the wire, but if not continued it had no right to do so upon a mere threat of the plaintiff that he would continue to violate the contract. This is an important decision as showing the rights of companies in protecting the telephone service from deadbeatism, and hereafter if the subscriber permits non-subscriber to use his telephone after receiving a written notice from the company, he will have no redress should the service be discontinued, provided this decision holds good in other courts as it very likely will.

*** The Chesapeake and Potomac Telephone Company is busily at work removing the wires and cables of that company from the top of the Treasury Department and White House, and making the connections with their underground system in the western part of the city. The same company is also laying two underground cables—one of one hundred wires and one of fifty wires—from the square between L and M Streets, between Vermont Avenue and Fifteenth Street, where they connect with the cables laid from the main office a year or so ago. These new cables run out Fifteenth Street north to O Street, where fifty wires go to a large distributing pole in the rear of the Riggs Market, and by poles east and west through the alleys. The remaining 100 wires continue out Fifteenth Street to a large distributing pole in square 207, in the rear of the Foundling Asylum, thence by pole lines through the alleys in every direction. The cables are the Patterson, are encased in leaden pipe, and laid in wooden boxes under the brick sidewalks, and embedded in asphalt. The electric part of the work is being done by employes of the Western Electric Company, of New York and Chicago, the manufacturers of the cables. Another cable is also to be laid on F Street, east of Fourteenth.

*** At Louisville, Ky., Judge Edwards held that the withholding of the telephone connections from the B. & O. to be an unjust discrimination, and contrary to the public policy. A corporation which serves the public is subject to the same principles of law which apply to common carriers. The Ohio Valley Telephone Company had refused the connection, in accordance with the parent company's Western Union contract.

*** We extract the following from the Boston *Transcript*:

BOSTON, June 24, 1885.

To the Financial Editor of the Transcript.: No extended notice of the legislative subcommittee's report of the examination of the Bell Telephone Company's books has, to the writer's knowledge, ever been made public. Those who have chanced to see the report may have formed some opinion, but no public conclusion could have been arrived at by reason of the fact that it has never been published in any of the dailies. The following are a few of the conclusions after a somewhat careful study. One of the most apparent facts is that the company certainly confined its answers to the questions asked.

The committee failed to inquire the names of all licensed companies, there being others besides those mentioned.

That, according to the report, there will come in for participation in dividends to the Bell Company, an additional number of shares, in 1885, 20,560; 1886, 30,920; 1887, 31,544; 1888, 23,440; 1889, 6,414, or a total of 121,878, in addition to those companies with whom they are yet to form perpetual leases—a large but quite indefinite amount. Among the latter is the Providence Telephone Company, one of the most prosperous in the United States, whose license expires in 1890.

Again, if naught can disturb the arrangements as they now exist between the subcompanies and themselves (and they have been strengthened of late), that it is reasonable to expect, after perfecting licenses with *all* the companies, an income from this source alone equal to what they now enjoy.

It would also appear that these same subcompanies will be the Bell Telephone Company of the future; furnishing its income, its business, its entire assets.

That at the expiration of its patent, it will be the strongest competitor of the Western Union Telegraph Company, capable of conducting what its probable intention has always been, a telegraph as well as a telephone business.

That the expiration of their patent rights will mean less than it does ordinarily, as they will remain intact, and in full possession of the field.

That the completion of the trunk lines will bind together the fragmentary parts as they now exist, and will make the corporation the most gigantic this country has ever seen.

That by their majority interest in the Western Electric Company they will be enabled to reduce the cost of all their apparatus to the minimum long before others enter the field as competitors.

Again, the amount of their purchases in sub-companies alone (presumably for cash) amounted at the time of the report to no less than $6,432,000, or two-thirds of their entire present capital, to which is to be added the value of $15,000,000 of franchise stock, constantly appreciating in value, and being added to yearly, almost monthly.

With 330,000 telephones in use March 20, 1885, according to this report, acquired in five years—two of which have been years of business depression—it would seem reasonable to calculate that by the time of the expiration of the patent in 1892, the number will exceed 500,000, which at present rental will yield some $3,000,000 income from this source alone. Add to this, say 5 per cent. on their present $22,000,000 in other companies, all dividend drawing long before this time, and we have as a reasonable income some $4,000,000. As the expenses have never increased in proportion to the receipts, one may naturally conclude that the net will not then be less than 30 per cent. upon Bell shares.

In conclusion, one can but admire the long-sighted business policy of its officers, who saw at the start the goal to be reached, and who bid fair to realize all their hopes.

*** Mr. John B. Hunt, who has so efficiently managed the Northern Division of the New England Telephone and Telegraph Company, has received a promotion to a much larger field, and his headquarters after about July 1 will be at Fitchburg, where will be the office of the new Northern Division. The new deal will make quite a change in the districts. It consolidates the Lowell division, including Lowell, Fitchburg and Ayer Junction, with a part of the Northeastern Division, including Concord, Manchester and Nashua, and a part of the old Northern Division, and Mr. Hunt has been appointed superintendent of this large and important district, with George M Rossman as assistant, who will be stationed at or near White River Junction. Greenfield and all the rest of Massachusetts west of the Connecticut has been consolidated into the Springfield Division, with F. E. Daboll, of that city, as superintendent. F. E. Bowker will continue in charge of the Greenfield office.

*** Superintendent Walker, of the Philadelphia Electrical Department, introduced a telephonic system of fire alarms which will greatly enhance the efficiency of that service. The object of the new system is to prevent mistakes which are liable to occur with the ordinary electrical apparatus in transmitting alarms. The system acts independently of the old method. It is operated by seventy miles of wire connecting each fire engine and truck-house with the patrol stations, Chief Engineer's office and the Electrical Department. There are from three to seven engines in each of the eleven circuits, and the Chief Engineer can go to any box and communicate with any engine-house, and can order any particular engine or hook and ladder company to any locality. The test was satisfactory. Engine-houses in Manayunk were called up and spoken to, as were also engine-houses in Chestnut Hill, Southwark and other parts of the city. Telephone messages from the Central Station pass through the main office, but messages from the engine-houses do not reach the Central Station until after they have been received at headquarters. At six o'clock in the morning and at noon the exact time will be sent to all the engine houses over the new wires.

Telephone Rates.

SUPERINTENDENT BEACH'S CONSTRUCTION OF THE NEW LAW IN INDIANA.

The policy to be pursued by the Central Union Telephone Company with regard to the law passed by the last legislature reducing telephone rentals to $3 a month has been developed in a circular sent to subscribers, which contains an elaborate statement of the company's claims regarding the cost of maintaining the service, and the following declaration regarding its intentions·

The law recently passed by the Legislature of Indiana fixes the price of the rental for the use of a telephone only, whereas, in each case there are furnished in addition many other things which go to make up telephone exchange service, such as lines, batteries, magneto bells, central office apparatus, constant labor of agents and employes in maintaining the same, services of operators at central offices, etc. The company proposes to conform to the law in the price of rental, and to make such charges for other material and for its services as are reasonable and proper.

This means that the company intends to continue their present charges. Some weeks ago legal notice was given that the existing contracts would be terminated June 30, and the superintendents were called to a meeting at Chicago, where the new plan was developed to them, and they were instructed what course to pursue. A new form of contract, expiring in three months, has been drawn up, and all subscribers will be required to sign it before receiving telephone service.

Its principal provision is that the subscriber applies to the company to rent him one magneto-telephone and one battery transmitter, and also to supply him with the necessary appliances for the purpose of connecting them with the exchanges, and he agrees to pay therefor the total sum of $15 in advance from the date of connection to 3 months from that time, and adds, "This contract shall be understood to be renewed for an additional 3 months, and so on for consecutive terms of 3 months each, until canceled by 30 days' notice from either party." It further explains: The above total sum is based upon the charges itemized as follows:

Rental of one magneto-telephone and one transmitter (two telephones) at the rate of $20 per annum. Labor and service charges, for switching, construction and maintenance charges for lines, batteries central office apparatus, magnetic bell, and other appurtenances at the rate of $40 per year.

It will be noticed that in the last enumeration that the company expect to keep their revenue up to its present standard. Mr. F. G. Beach, General Superintendent of the Central Union Telephone Company says in an interview:

"The law passed by the last legislature we believe to be unconstitutional, and in due time it will be contested in the courts, but when, how, and by whom, I am not prepared to say. We have already given notice to subscribers that their contracts would expire on the 30th inst, and to bridge over the difficulty from that time until a final decision is reached in the courts, we have adopted the plan that is outlined in our circular sent out to-day. You will notice that the new contracts are for only three months, although, if we desired, we could make contracts for a year on the old tariff and they would not be affected by the new law, which does not go into effect until about July 15, and which cannot be retroactive."

"Have you legal advice that your plan of charging the extra $40 a year for service, appliances, etc., is not a clear evasion of the law, and that it will not be held to be an illegal charge?"

"We have such advice from a number of the best attorneys in the country. We do not regard this as an evasion of the law, but an attempt to reorganize the business of the company, in direct conformity with the statute, which allows us to collect $3 a month for rentals, but says nothing about any other charges. On the other hand, if the Supreme Court holds that these charges are illegal, the company stands ready to refund the money to the subscribers, but it will close up business at the same time. I expect that the payment will be contested, and we may have a good many suits from it, but, as I told you before, this is intended as only a temporary expedient to bridge over the time until a final judgment is reached in the courts. There is no use talking about us operating exchanges throughout Indiana at the reduced rates, for we can't do it, and we are compelled to do something to keep the rates at what they are now, at least."

"Will you make any other changes in your present system?"

"None of very great importance," was the answer. "In some towns where we purchased exchanges there have been a number of subscribers who, for local or particular reasons, have been having special reduced rates, and we intend to bring them up to the standard, for the legislature also passed a law prohibiting discrimination by telephone or telegraph companies among their patrons. As fast as the company finds it equitable to make concessions it will gladly do so, but the lowest rates are the lowest we can possibly afford."

Said the reporter: "Another telephone company has recently given publicity to the statement that if you abandoned the business in Indiana they will take your exchanges and lines and operate them at the reduced rates provided by the new law — how is that?"

"They cannot do it, and they know it; and no other company can. All this talk is in the nature of a bluff on their part, in the hope that they may sell some of their stock, which I regard as worthless, for they have no property, and are now under an injunction. Even at our present rates there is no profit in the business, and I will say to you that I have telephone stock to sell, and I was one of the original investors, and I will sell it at 25 per cent. less than it cost me."

Informal Meeting of the Brooklyn Underground Commissioners.

An informal meeting of the Underground Wire Commissioners was held last week at the Mayor's office, Brooklyn, to consider the application of the New York and New Jersey Telephone Company for permission to lay their conduits for wires in Washington Street while the pavement is up. Commissioners Raymond and Reynolds were present. The Board had not yet organized, but it was thought by the Mayor and Commissioner of Public Works, when the application was made, that possibly some agreement might be reached whereby the telephone company might proceed immediately to lay its wires while the city was widening and repaving the street.

Mr. W. D. Sargent, general manager of the company, appeared before the Commissioners and said: We made an application last week to the Commissioner of Public Works for a permit to lay conduits in Washington Street while the pavement was up, in order to save us the expense of again tearing up the street, and also to prevent further annoyance to the public. The Commissioner referred the matter to the Mayor, and it was thought necessary to consult with you. We are not strenuous about the matter, but feel that it would be an advantage to the residents along Washington Street, and a slight saving in expense to us if we could go upon the street and do our work in conjunction with the city.

Commissioner Raymond—Do you propose removing your poles when the wires are placed under-ground?

Mr. Sargent—No, sir. We shall not take our poles down for several months, possibly a year. We don't believe in crossing a river and burning our bridges after us. The placing of wires under ground will be an experiment, and we must give the matter a fair test before we abandon our wires overhead.

Commissioner Reynolds—You have some wires under ground, have you not?

Mr. Sargent—We have at present about 200 miles of wire under ground in Brooklyn, and they are working very well. The total distance of wires is about 3,000 miles. In Europe, where the experiment was first made, it was not a success. It may be the same way in New York and Brooklyn. The cost in Europe of underground wire was from 10 to 25 times greater than overhead wires. In this city I estimate that the cost will be from four to ten times greater. We are perfectly willing to submit to any reasonable regulations, and are ready to comply with the law. You must not expect us to abandon our poles until we have given the underground system a fair trial.

Commissioner Raymond—Of course this is merely an informal meeting, and we have no authority to act in the matter. The Board is not even organized, and we cannot organize to-day. The law requires that ten days' notice shall be given of the first meeting of the Board. On my part, this delay is not voluntary. I would be willing to act in the matter at once if it were possible. I recognize the advantage of permitting this company to lay its wires while the street is being repaved. We would certainly, however, be subject to criticism if we took any action or gave tacit consent by which the company could go on and build its conduits.

Commissioner Reynolds—I am entirely of the same opinion. The Board can do nothing legally until after the date of its formal organization on the 9th of July. The improvements on Washington Street will not be completed by that time, and the company will be able to go on with its work without much delay. I can't see that we have any authority to proceed in this matter.

Mr. Sargent—Well, gentlemen, we, of course, recognize the position you are in, and do not insist upon the granting of our application. At the same time, if there was any way by which we could proceed at once with this work, it would be a matter of some little advantage to us.

Mayor Low entered the room at this point, and after consulting with the Commissioners, agreed with them that no action could be taken in the matter.

Southern Telephone News.

ATLANTA, GA., June 24th, 1885.

Editors Electrical Review:

Since my last letter from this, the capital City of the Empire State of the South, many changes have occurred here. The one felt most was the sad death of Clarence H. Robinson, Superintendent of Construction, which occurred May 1st., after an illness of only one week, from typhoid fever. To those intimately associated with Mr. Robinson it was hard to believe he was dead. He was a young man of exemplary habits, acknowledged ability, good health, and physical strength almost wonderful, and with a cheerful disposition which made him an universal favorite. Although very stern with his men, he not only commanded their respect, but had their love. He entered the telephone business in October 1879 at Orange, N.J.; afterwards built the exchanges at Seneca Falls, Geneva, Waterloo and Canandaigua, N. Y., and then came with the Southern Bell Telephone and Telegraph Company. He built several exchanges, and was finally made Superintendent of Construction with headquarters at Atlanta. He put his whole soul into the Atlanta Exchange and leaves as a monument to his ability an exchange which will compare favorably with any in the country, and many experienced men say it is the best constructed exchange they have ever seen. Mr. Robinson was a native of Orange, N. J. He was married in December, 1884, to Miss Lizzie Richardson of this city, and had settled down with the expectation of making Atlanta his permanent home.

His funeral was very largely attended, and the floral offerings were profuse, appropriate and elegant; the central piece being an immense bed of white flowers nearly 6 feet long with three tall posts, each having three cross arms, covered entirely with flowers, and wires of smilax from pole to pole, one wire being broken, as an emblem of the broken circuit in his life. Mrs. Robinson has a host of sympathizing friends in her misfortune. During his illness he received the best attention possible, his wife and brother, W. C. Robinson, being constantly with him. His death was a serious loss to the telephone company, and his place will be hard to fill. Men of his ability, energy and experience are very scarce, and the company will have to look well to his successor, or feel his loss in the future.

Yours truly,

ATLANTA.

Statistics Relating to Telephone Companies in the United States.

The following statistics of the telephone business in this country for 1884, mostly furnished by the licensees of the American Bell Telephone Company, will be found of great interest:

On December 31, 1884, the capital stock issued, and investment, of 64 telephone companies (and individuals) in the United States amounted to	$53,342,141.16
Increase in 1884	3,388,789.16
Of 45 companies having an aggregate capital of	51,490,751.16
The gross earnings were	9,050,218.85
" expenses were	5,755,415.62
" net earnings were	3,294,803.23
Per cent. of expense to gross earnings	63 50-100
" net earnings to capital	6 4-10
Increase of gross earnings over 1883, 30 companies	1,069,041.81
Increase of expenses over 1883, 30 companies	737,744.16
Increase of net earnings over 1883, 30 companies	331,297.65
Increase of net earnings, 1 company	4,185.19
	$335,482.84

Taking the above figures as a basis, the entire business of the telephone companies in the United States for 1884 may be estimated as follows:

Gross earnings	$9,500,000.00
Expenses	6,050,000.00
Net earnings	3.450,000.09
The aggregate of dividends declared during the year was	1,921,239.24
Gross receipts from extra-territorial business	512,024.38
Number of telephones and transmitters reported in use	313,112
Average net income per instrument	$11.00
Number of exchanges in the United States	772
Number of exchanges built in 1884	63
Number of exchanges discontinued or made branch offices and toll stations	197
Number of branch offices	482
Number of exchange subscribers	134,847
Increase since January 1, 1884	11,222
Number of toll stations	3,341
Number of private line and other stations	12,868
Total stations	151,056
Length of cables in use, feet	582,442
Exchange systems, miles of wire on poles	88,607
Exchange systems, miles of wire on buildings	11,902
Exchange systems, miles of wire under ground	1,225
Total miles of wire	101,734
Miles of wire, January 1, 1884	85,896
Increase in 1884	15,838
Number of extra-territorial lines	826
Miles of extra-territorial pole lines	25,766
Miles of extra-territorial wire	35,631
Increase in mileage of extra-territorial wire during 1884	6,272
Number of day operators employed	2,623
Number of night operators employed	773
Total number of employes	5,700

Cities and towns in the United States in which no exchange or branch office is located:

Places of	3,000 to 5,000	population 95
"	5,000 to 10,000	" 9
"	10,000 or more	" 1

The average number of calls in exchanges, and average cost to the subscriber per connection made up from the figures given by all companies reporting, are:

			Calls.	Cost, Cts.
In exchanges of	100 or less	subscribers	4	4
"	100 to 200	"	4 5/6	3 2/3
"	200 to 500	"	4 6/10	3 1/10
"	500 to 1,000	"	5 2/10	3 1/10
"	1,000 to 1,500	"	5 3/10	3 1/10
"	1,500 or more	"	5 7/10	5 5/10

The total number of exchange connections daily in all exchanges in the United States is 697,966, or 20,938,980 per month, 251,267,760 per year.

Average number of extra-territorial messages daily, 8,330; or at the rate of 249,900 per month, 2,998,800 per year.

Total of construction and investment accounts, reported January 1, 1884	$28,209,866.27
Added during 1884	2,363,787.39
	$30,573,653.66

.... A long-distance system of telephony by the existent telegraph wires was opened for service on the 1st inst., between Brussels and Liege.

.... A half-yearly dividend, at the rate of five per cent. per annum, is notified on the shares of the Great Northern Telegraph Company, England.

.... It is said that 1,000 less messages per day were handled at the main office of the Western Union Telegraph Company in Boston in the first four months of 1885 than in like months last year

.... The estimated traffic receipts of the West India and Panama Telegraph Company, for the half month ended the 15th ult., are £2,984, as compared with £3,066 in the corresponding period of 1884. The February receipts, estimated at £4,722, realized £4,854.

.... Charles Selden, superintendent of the Baltimore & Ohio Telegraph Company, has been presented with an elegant fishing rod by Mr. John A. Robb, of Baltimore. Mr. Selden is an expert angler, as well as one of the best telegraph superintendents in the country.

.... Articles of incorporation have been filed for record of the Franklin Electric Works, of Baltimore City, with Franklin Folger Pope, John Francis Eline, William Riley Pope, James Bush Guyton, and Benjamin Franklin Pope incorporators Capital stock, $1,000. The corporation proposes to manufacture all kinds of electric supplies.

.... At the Birmingham police court three youths have been fined 5s. each and costs for breaking telegraph insulators. The inspector of the local telegraph department said that no fewer than 2,000 insulators had been broken along the telegraph wire by the side of the Birmingham Canal since January last. Each insulator cost 1s., without reckoning the expense of fixing.

.... After a hearing in the United States Circuit Court in Hartford, Judge Shipman vacated the stay imposed by Judge Wallace, of New York, upon Gen. Harland, receiver of the American Rapid Telegraph Company, and permits the receiver to enter into any arrangements with other companies or corporations which he may deem best for the interests of the property.

TELEGRAPHIC

.... Last week telegraphic communication with India was completely stopped owing to a break-down of the cables.

.... The Woodward Underground Telegraph Company, of Montreal, has issued its prospectus. The capital stock has been placed at $200,000, and the plant for that city and environs is $100,000.

.... Contractors have commenced the work of completing the Southern Telegraph Company's lines from Meridian to New Orleans. As soon as the line is completed Mutual Union and Southern Telegraph offices will be established in New Orleans and in other cities of the South.

.... Miss Frederika Gilbert, manager of the branch office of the Western Union at 339 Broadway, was drowned near Poughkeepsie, N. Y., July 5th, while bathing. Miss Minnie Kelley, of this city, an expert swimmer, was with her, and was also drowned, the two being found locked in each other's arms.

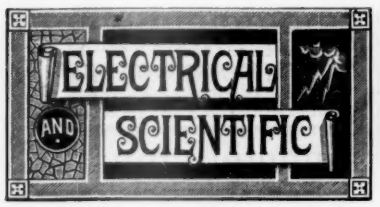
... Several telegraph operators were standing at the corner of Fourth and Pine Streets, St. Louis, at 2 o'clock the morning after the Fourth, when Almer E. Tong, an operator, and William Kaiser, a lineman, became involved in an altercation, and Tong was knocked down and kicked until he was dead. The men had been drinking. Kaiser surrendered himself.

.... The annual meeting of the Philadelphia, Reading and Pottsville Telegraph Co. was held at Reading last week. The officers elected were: President, George DeB. Keim, of Philadelphia; directors, J. B. Lippincott and Joseph Wharton, of Philadelphia; R. H. Sayre, of Bethlehem, and G. A. Nicolls, of Reading; secretary, Howard Hancock, of Philadelphia; treasurer, John Welch, of Philadelphia.

.... The Secretary of the Navy has issued a circular, in which he says: "The telegraph should not be used at the public expense when a communication by mail would answer all purposes. In many instances no care is taken to reduce the message to its lowest, clearly intelligible limits, and much unnecessary verbiage is used. Telegrams, strictly personal, or for the convenience or in the interests of the sender, must not be transmitted at Government expense.

.... D. H. Bates, President of the Baltimore & Ohio Telegraph Company, has signed a contract with the Averell Insulating Conduit Company for placing the wires of the telegraph company under ground. The work will be begun in Washington immediately. The insulating material, in which the naked wires are laid, is composed of pure silica and refined asphaltic cement. From experiment already made, it is claimed that 1,600 wires can be laid to the square foot, the insulation being so perfect that the strength of four dynamos was not sufficient to drive the current from one wire to another.

.... The American Train Dispatchers' Association Convention at Denver, Col., elected the following officers for the ensuing year: J. W. Lynahan, Corning, N. Y., president; A. J. Frazier, Seymour, Ind., vice-president; Isaac McEwen, Buffalo, N. Y., was re-elected secretary and treasurer. Executive Committee—A. R. Dill, Hinton, W. Va.; Hugh Daly, St. Thomas, Ont.; H. M. Forrent, Boston; W. F. Larimer, Pueblo, Col.; J. W. Stapleton, Chicago; J. Fitzsimmons, Plaquemine, La.; A. G. Hartigan, La Crosse. A proposition to incorporate the insurance feature in the organization was voted down. A resolution for the formation of local lodges was adopted. The secretary's salary was increased to $1,000. It was decided to send three delegates to the Superintendents' Convention at Chicago, October 8, to present the conclusions of this convention. The next meeting will be held at Chicago the second Tuesday of June next year.



* * It is proposed to try to save the scaling and crumbling obelisk in Central Park by filling the cracks with paraffine, applied at melting temperature.

* * "There was a man once on a time who thought him wondrous wise; he swore by all the fabled gods he'd never advertise. But his goods were advertised ere long, and thereby hangs a tale; the 'ad' was set in nonpareil, and headed 'Sheriff's Sale.'"

* * The temptation to the average young man using the telephone to say something pretty to the pleasant-answering voice from the far-off other end of the wire has become such a nuisance that not a telephone directory is published now without a statement to the effect that "the exclusive duty of operators is to answer calls; they have no time for conversation."

* * At the Royal College of Science, Dublin, electrical accumulators are employed in connection with inductoria, for which they are obviously well adapted, on account of the very even flow of current which they give, and of their ability of producing very powerful currents, and more particularly on account of the very slight attendance which they necessitate.

* * The United States Government is the greatest printer and publisher in the world. The aggregate number of government publications issued annually amounts now to about 2,500,000, of which about 500,000 are bound volumes. This is the maximum. But a moderate estimate will put the aggregate publications of the government from the beginning until to-day, at from $30,000,000 to $40,000,000.

* * An American writes that he saw in Bartholdi's hands in Paris, two years ago, communications which he had received from our Government in answer to his inquiries regarding the possible wind currents in New York Harbor, and all the tests of strength to which the statue might be put in its exposed position. He says that he had prepared the framework of the statue for every contingency, and it is safe to predict for it a long life on Bedloe's Island.

* * The incorporators of the North Central and South American Exposition met in New Orleans, and elected the following officers; James B. McConnico, president; R. G. Howard, first vice-president; Geo. L. Sharp, of Idaho, second vice-president; S. H. Buck, director-general; Richard Nixon, secretary. Mr. Petit, who was chief of installation at the Philadelphia Exposition, it is stated, will be tendered a similar position with the new company.

* * Electricity has now been applied for cutting glass tubes, an operation of some difficulty when the diameter is large; an iron wire, half a millimeter in diameter, is wound round the tube at the place required to be cut, and the ends are connected with the poles of a powerful battery or other generator of electricity. This iron becomes heated when the current flows, and it is only necessary to cool it suddenly with a few drops of cold water in order to produce a clear cut. The *Journal of the Society of Arts* remarks that glass tubes four inches in diameter are now cut in this way.

* * The suggestion having been made that the ignition of petroleum tanks may sometimes be caused by sparks from the rain of thunder-clouds, some interesting results obtained with an old piece of apparatus have been called to mind. In these experiments an electrometer showed that the drops of occasional showers are almost always more or less charged with electricity, and that it is only totally absent during foggy, moist days, and long storms. The strongest charges were obtained during thunder-storms, but the air even has given indications occasionally of an electrical charge without any fall of rain.

* * Prof. Fleming Jenkin, of Edinburgh, a distinguished scientist, died recently. In 1857 he had charge of the electrical testing of the first Atlantic cable during the progress of its manufacture; and in 1865 was appointed professor of engineering at University College, London—a post he held until he became the first occupant of the chair of engineering at Edinburgh, a professorship which he held until his death. The loss of such a man in the prime of life, just as his scheme of telpherage or electrical transmission, is about to be put into practical work, is to be regretted, for his many-sided experience would have been of great value in determining several questions which are attracting much attention.

* * The world's annual demand for cacao, or cocoa, is steadily increasing, and seems fair to outrun the supply. The culture of this tropical product is very profitable, and on some of the West India islands the cocoa growers live luxuriously on their great plantations. For young men with capital, no more promising investment than a cocoa plantation can be found, and the recent invention of a drying machine for the cocoa bean, which does the work excellently, and at the same time avoids the waste of the common sun-drying process, is likely to add to the profits of the industry. It may almost be said that, as civilization extends itself, cocoa and its refined product, chocolate, grow more and more in demand.

* * The revenues of the Post Office Department will be seriously affected by the new Post Office legislation. Letters weighing one ounce or less may be sent through the mails for two cents, and the rate on newspapers mailed by publishers will be reduced from two cents to one cent per pound. From the reduction in the newspaper rate a large deficit is expected to result. The deficit for the year just expiring is roughly estimated at $4,000,000, and the estimate for the new fiscal year contemplated a deficit of $4,826,000. This estimate, however, was prepared without knowledge of the reduction in newspaper rates to be made by Congress during the last weeks of the session. In the opinion of the financial officers of the department, this legislation will cost the Government at least $1,000,000 during the next fiscal year, and will swell the excess of expenditures over receipts to $6,000,000.

* * Two useful inventions are described in a London journal as promising largely to increase the quantity of gold extracted from minerals. One of these is an improved mercury amalgamating machine, by which the yield of gold is notably augmented, and most of the "float" or "flower" gold hitherto lost under the best processes is saved. What is regarded as still more important in this line is a very ingenious application of electricity with quicklime and common salt, by which, as is claimed, the most intractable of auriferous ores are compelled to yield up their whole charge of precious metal. The rate of production, as proved by exhaustive tests made at London, shows about one ton per hour of ore for one small dynamo machine, and while the certified cost amounts to but a few shillings per ton, the value of the gold gained is said to average ninety-five per cent. of all that the ore contains—a most remarkable result, as compared with other methods. And yet beware of mining stocks.

* * There has just been completed at Cornell University the largest galvanometer in the world. It was built under the direction of Prof. William A. Anthony of the department of physics, and over a year was spent in the construction. The instrument contains all the accessories that are necessary for making the most complete and accurate measurements of any kind of electrical apparatus, and is valued at several thousand dollars. There are four circles, each two meters in diameter. Dr. Guyer, of the Stevens Institute of Technology, and several electrical engineers from a distance, with Profs. Anthony and Moter of Cornell, are at present engaged in making tests by the aid of the galvanometer of the strength of the currents of a powerful dynamo sent here for that purpose, which is run at 1,200 revolutions a minute. The instrument has been mounted and placed in the physical and chemical laboratory building, and will prove a valuable addition to the electrical engineering department of the university.

The Baltimore and Ohio Main Office Burned.

OPERATORS CHASED FROM THEIR KEYS TO THE ROOF BY FLAMES—HEAVY DAMAGE BY A BLAZE IN LOWER BROADWAY.

The boys who were setting off fireworks in the lower part of this city about 8 o'clock the night of the Fourth, making the streets lurid on a small scale, abandoned pyrotechnics, raced after a long string of fire engines down Broadway, and clustered in the streets in thousands watching the blaze that burst through the roof and windows of the Baltimore and Ohio Telegraph building at 63 Broadway, in the middle of the block below Rector street. The building is of brown stone, five stories high, and was leased by the telegraph company, which sublet part of the first floor to the Baltimore and Ohio and the Delaware and Lackawanna Express companies. The building, like those adjoining it, occupied by the American Express Company at 65, and the Hamburg steamship line at 61, ran through the block to Trinity place.

Janitor Edward H. Stedman, an old fire laddie, was smoking his pipe in his rooms on the top floor of the building, Trinity place side, while his wife and his 15-year-old son John, the only one of his five children who was in the building, were at the windows watching the sky rockets. Mr. Stedman smelled burning wood, and, opening the door into the hall, saw thick white smoke and an occasional darting flame chasing one another up the elevator and light shafts. He shouted "Fire" to warn the telegraph operators at work on the top floor, and hurried his wife and son down into the street. Smoke was puffing into the street around the basement doors and through the iron grating over the areaway.

Twenty-one young operators were at work on the top floor, Broadway front, under Chief Night Operator Moffatt, and Electrician, H. F. Dodge, was there also. A young operator who sat near the open doorway was the first to smell the smoke, and jumping from his chair he yelled to his companions, "Get out, boys; the house is on fire!" Several of the younger operators tumbled down the stairs in their hurry. Chief Moffatt advised the others to try the roof. A month ago a suspended ladder, to furnish easy access to the roof, was hung in the center of the long operating room. When not in use the ladder was drawn up and rested parallel with the ceiling. Mr. Moffatt lowered it in a twinkling by loosing the string which kept it in place, and the foot of the ladder dropped and rested on a long operating table. The operators were not long in getting to the roof, and Moffatt and Dodge were the last up. All made their way, without any accident, down through the adjoining building into the street.

A minute later, just as engines 6, 4 and 10, and trucks 1 and 15 were getting to work at the smoking basement in front, the flames burst through the roof and the windows of the upper floors, and on the Trinity place side the lower part of the building was hot with fire. A second and a third alarm followed, and as rapidly as the Morse key in the signal box could be worked, special calls for four more engines were sent out. In a very few minutes fifteen engine companies, the water towers, and four truck companies were at work on the building. The thick smoke from the basement hid the firemen on their ladders. Suddenly the smoke disappeared almost entirely, and flames darted up through a dozen places in the roof and sprang half way across Broadway from the fourth and fifth story windows. On the Trinity place side the fire was just as hot and the flames licked the elevated railroad structure, making it impossible for trains to pass.

On the Broadway front networks of wires ran from the roof down to poles on the west sidewalk. They were insulated at this end, and fire ran along the insulating material out over the street. Then the wires reddened, and writhed and parted at the roof end and swung down on the firemen, breaking into short lengths in a red hot shower on the sidewalk. An American flag on the American Express building next to the north, floated unscathed amid a storm of upward bound sparks.

The water tower did the most effective work on the fire Stationed directly in front of the building on Broadway, it poured its big stream through the top floor windows. Part of the roof fell in with a crash, and then part of the fifth floor gave way. Pieces of the cornice and bricks fell in showers on the sidewalk. Fireman Francis Radley and Michael Kirwan, of Engine No. 6, were at work on the first floor rear, when a mass of wood-work fell on them. They were carried out by their companions, and taken to the engine-house in Cedar Street. Several of Radley's teeth had been knocked out, and his back had been badly contused. Kirwan's face was lacerated, and he was also injured about the body. Several other firemen were cut by falling bricks and glass, but were not badly hurt. Firemen Ed. Russell and Ed. Smith, of Engine 4, were slightly injured, and Frank Burke, of the same company, was partially overcome by smoke.

After two hours' work, the fire was under control. The basement, the first floor, and the fourth and fifth floors were burned out. The basement of the building was occupied as the telegraph company's store-rooms, the cashier's office, and delivery and messengers' rooms.

The building, which is insured for about $50,000, is damaged at least $30,000, and the Baltimore and Ohio Company estimate their loss at $40,000. The express companies had but little baggage in their offices, and their loss is not heavy.

All the messages on the hooks of the telegraph office were saved, and sent to the Brooklyn office for transmission. The company secured rooms the next morning on the top floor of the adjoining building at 61. The wires entered the old operating room by way of a cupola on the roof, on the Broadway side. This was not much injured, and many of the wires were still attached to it. The cupola and wires were easily removed to 61. A large room on the fourth floor, Broadway side, of the old building had recently been fitted up as an operating room for lady operators. A large number of desks and batteries had been put into it. The fire did not reach this room, and the instruments, batteries and desks were moved into the new offices. All the large offices near the city were notified to send in their spare materials, and by Tuesday of this week the Baltimore and Ohio was in fair working order. This is the kind of enterprise that counts, and is characteristic of the management of the Baltimore and Ohio

*** An electric storm, accompanied by heavy rain and wind, prevailed at Jamestown, N. Y., on Sunday afternoon. An oil tank at Carrollton, with 11,000 barrels of oil, was fired. Five cannon balls discharged into the lower part of the tank allowed the oil to escape, and prevented a big conflagration. A cow standing under a tree at Levant was killed. The Free Methodist Church at Vermont was struck in the belfry, which was splintered and scattered into the surrounding fields. The large congregation was severely shocked and terribly frightened. The telephone poles for half a mile at Kennedy were shattered. A pane of glass and a steel lock were knocked from a door of A. Crane's house in Jamestown, no other trace of the bolt being visible. A house at Ross had the chimney demolished, the clapboards stripped off one end, and a floor sill taken out. A great many persons were severely shocked.

*** Charles Scott, a lineman, employed by the Chesapeake and Potomac Telephone Company, Baltimore, met with an accident by which he narrowly escaped from being instantly killed. He was engaged at the time in assisting to run the aerial cable along German Street, near Greene, and had climbed a pole 60 feet high for the purpose of throwing a rope over some wires. While in the act of throwing the rope he lost his hold and fell head downwards. In falling, the strap that fastens the spur to his leg caught on a heavy No. 8 wire and suspended him forty feet above the ground. He was, while in this position, enabled to clasp the pole and remain in that position until a fellow-workman mounted the pole and raised him to an upright position. Instead of coming down he kept on and finished his work. Had he fallen he would have struck upon a lot of old iron at the foot of the pole, and would undoubtedly have been killed.

Articles of Association of a St. Louis Electric Railway Company.

Articles of association of the Electric Railway and Power Company, of St. Louis, were filed with the Secretary of State last Monday. Capital, $350,000. The articles of association set forth the purposes of the organization as follows:

"This company may contract, maintain and operate an elevated or surface railway of standard broad gauge for public use in carrying persons to and from a point in St. Louis at or near the intersection of Seventh Street and Russell Avenue, or some other point in that vicinity, thence running in a northwardly direction to a point at or near the intersection of Broadway and St. Louis Avenue; thence westwardly by the most practical route to the Fair Grounds; thence southwardly to Russell Avenue; thence in an eastwardly direction, to connect with said railroad at the point of starting.

"The company may also construct, maintain and operate another line, which shall commence at or near the intersection of Laclede and Grand Avenues; thence running in a westwardly direction to or near the western limits of the City of St. Louis. The entire line of said railroad is to be constructed with single or double track, and to have such switches, turnouts, depots and stations at different points and places along the line of such railroad as the officers of said company may deem proper. The length of the road shall be ten miles, more or less. The line of route of said railroad is subject to be changed and modified in such respects as may be mutually agreed upon between the company and the city authorities.

"The company may also, as incidental to the business of said railroad, distribute and sell electricity, to be used as motive power, or for other purposes, throughout the districts traversed by said railroad, or embraced in the above-described routes. And may also construct, maintain and operate such electric wires as may be found necessary for public or private use. The said roalroad is to be operated by electricity, to be generated at one or more points along the routes of said railroad." Following is the Board of Directors, all of whom reside in St. Louis: John W. Harrison, John Jackson, B. D. Lee, John N. Bofinger, Aug. Gehner, John W. Donaldson, Chas. Hoyle, T. S. McPheeters, R. D. Lancaster, Francis E. Nipher, Wellington Adams, Chas. Thaw, Edwin Harson.

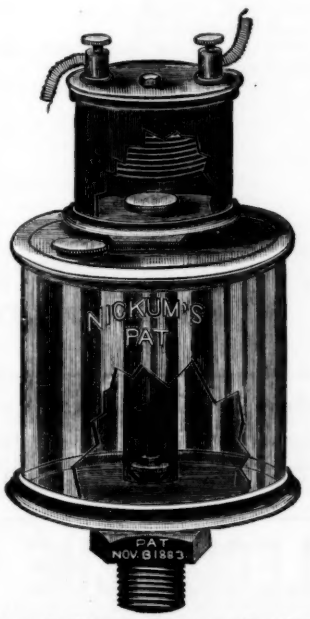
Electric Oil Cups.

The application of electricity to mechanical appliances is becoming more extended every day. We illustrate to-day a very novel and useful application of it.

This invention relates to that class of oil cups or lubricators consisting ordinarily of an oil chamber, usually of glass, with a vertical valve stem for regulating and controlling the flow of oil, and designed for application to shaft bearings, journals, and other parts of machinery requiring lubrication. The novelty of the invention consists in the combination of an oil cup and its valve stem of an electro-magnet, with suitable electric connections, whereby any or a series of these oil cups in an establishment may be operated at will, and simultaneously, if desired, to lubricate the machinery.

Hitherto the lubrication of machinery, particularly line shaft journals, has been a source of much annoyance in manufacturing establishments, from the fact that each and every cup requires individual inspection and adjustment to prevent unnecessary waste of oil, and, in case of line shafting, necessitating the approach of an attendant to within dangerous proximity of the shafts and pulleys, which results not unfrequently in the loss of life or limb. Furthermore, to insure constant lubrication by the old plan of oil cups, the valves have to be left open so far that great and unnecessary waste of oil results, and to prevent this waste the valve has to be adjusted so fine that the least sediment in the oil will fill up the oil passage, leaving the journals without oil.

By the employment of this invention, the superintendent or foreman of a shop, at a single, and if desired remote place, can, whenever necessary, or at stated intervals, operate all of the oil cups simultaneously by merely pressing the button of an ordinary telegrapher's tap key, or by the use of a switchboard, he can operate all the cups of any given piece of machinery, or any particular line or countershaft. The advantages of this system are self-evident to any one at all familiar with the running of machinery or manufacturing establishments. The wires extending from all the cups may be brought into the same circuit, so as to be operated by a single tap key, if so desired, or may be grouped into different circuits, as the necessities or conveniences of the case require, with different keys for each circuit, or by the employment of a switchboard of the usual or any suitable construction, a single key may be used to operate any one or more of the cups, either singly or in sets, as desired. Or, in some instances, it may be feund desirable to employ clock mechanism to open or close the circuit at stated intervals, thus insuring positive and regular lubrication. When the electric current is sent through the helix, the electro-magnet attracts the armature on the end of the valve



NICKUM'S PATENT ELECTRIC OIL CUP.

stem, and raises the valve to permit the flow of oil. When the current is broken, the valve stem drops by its own gravity closing the valve, thereby cutting off the flow of oil.

By operating the key intermittently, the valve will rise and fall, and the oil will pass from the cup in drops, or, by holding the key down for a greater or less length of time, a continuous flow of oil will be the result, as will be readily understood by the accompanying engraving.

On steamships that are run by screw propellers, where the screw shaft runs down in the hold, it is very inconvenient for the engineer to lubricate the journals by the old plan; but with this invention the engineer can, from the engine room, lubricate any single one, or all the journals, without waste of oil or inconvenience. Mr. Nickum also has, in connection with his oil cup, a clock mechanism that can be regulated to operate the cups so as to feed a drop of oil a minute, or a drop an hour, as may be desired. The only attention it requires is to be wound up every eight days.

All information desired concerning this invention can be obtained from the inventor, Mr. Geo. S. Nickum, Dayton, Ohio.

.... The prospects of the Sixpenny Telegrams Bill have not been improved by the advent of a Conservative Government in Great Britain, and in any case there is no likelihood of the scheme coming into operation before the autumn.

.... The telegraphers of the country have a mutual benefit association, with a membership of 2,800 and a reserve fund of $40,000. Since its organization it has paid to heirs of members over $250,000.

—— Paris engineers are discussing plans for a monument to be 1,180 feet high, with a single electric light of such intensity as to turn night into day over the whole city and suburbs.

—— The new works of the Forest City Carbon Manufacturing Company, Cleveland, are 50 by 200 feet, and will soon be ready for turning out carbons. The capacity will be 600,000 per month.

—— One of the most important features of the Ryan Hotel, St. Paul, will be the incandescent electric light, installed by the St. Paul Electric Light and Power Company, and is Edward Weston's latest advance in the incandescent field. There will be 101 large mogul lamps of 125 candle-power, and 320 of sixteen candle-power, giving a total of over 16,000 candle-power, equal to 1,000 lamps of sixteen candle-power, the whole driven by a 60 horse-power engine.

—— The Schuyler Electric Light Company have just opened a Boston office at No. 28 Pemberton Square. Messrs. Taft and Westervelt, gentlemen well known in business and social circles, have taken the management, and, as the result of this move, the Schuyler Company have received an order for an arc light plant for Marlboro. And several other negotiations pending promise as enthusiastic a reception for their system in Massachusetts as it has received in its own State. This company have just declared a quarterly dividend of two per cent., payable July 15.

—— New Britain, although the birthplace of one of the most prominent electric light companies, has until June been without the light itself. The local company then formed adopted the Schuyler system. To show the city what the light was they put up as illustrations some fourteen street lamps in different parts of the city. In one locality especially, where the nightly brawls had disturbed the neighborhood for years, the brilliancy of the light was too great, and the roughs dispersed. The city has contracted for all of the fourteen lights, and petitions already point to an immediate increase of fifty more.

—— The *Canadian Magazine of Science* expresses the opinion that electric light corporations do not exercise sufficient care and caution in the locating and erecting of stations where the convension of steam power into electric energy is intended to take place, and continues: "When we see in the principal cities of Canada, stations erected at great cost and elaborately furnished with steam boilers and numerous engines running at from 6 to 8 lbs. of fuel per horse-power per hour, we cannot be blamed for criticising a state of affairs which is highly damaging to the best interests of electric lighting and ruinous to the stockholders. The present age has demonstrated beyond a doubt that, if economy is wanted, circumstances and conditions must be obtained to admit of the application and use of compound condensing engines, so as to get the maximum of power at the least possible cost. Now there is no reason why in the majority of our cities these conditions should not be fulfilled, and we think it is high time to at once shape for such a course. Take, for example, the electric lighting stations in the two first cities of Canada, viz., Montreal and Toronto. We find to our astonishment that electric light stations are located in some very undesirable and unconvenient nook, and, notwithstanding the fact that an inexhaustible source of water lies near them, also numerous locations suitable for electric light stations, where steam appliances could be arranged to run easily at one-third the present cost, old-fashioned and very expensive courses are adopted. The reason, perhaps, for all this is the fact, consulting engineers are rarely, if ever, called in to assist those less able to decide on such important matters. It is high time that such false pride and reserve were abolished, and the services of our consulting engineers valued. Parties should recognize that the obtaining of special advise and assistance from consulting engineers is attended with very satisfactory results, and, without it, blundering and loss will more or less take place."

ELECTRIC LIGHT NEWS

—— The electric light now illuminates Congress Park, at Saratoga Springs, at night, and the effect is very brilliant.

—— It is stated that Mr. Ellis Lever, of Bowden, near Altrincham, has renewed an offer of £500 for the best portable electric lamp to be used in mining operations.

—— The Brush Electric Light Company are erecting six towers at Indianapolis, at their own expense, and will light them soon, in order to demonstrate that the Capital City cannot afford to do without this light. The towers are from 90 to 130 feet high.

—— One of the largest single electric lights ever constructed was placed on exhibition at Seneca Falls, N. Y., on a recent Saturday evening. It was of 50,000 candle-power, and was made in Ilion. The light was placed on the tower of a building at a height of seventy-five feet from the ground. It is intended to illuminate the whole village.

—— The electric light installation for the railway station of San Pierdarena, Italy, is nearly completed. The dynamos will be driven by two turbines; the nine arc lamps are of 6,000 candle-power each, and the total cost is estimated at £4,000. The little town of Aosta has recently been successfully lighted by Cruto incandescent lamps. The current is supplied by a Thury dynamo.

—— The following resolution was unanimously adopted by the State Senate of Pennsylvania, June 12th: "Resolved—That the Committee on Public Buildings be commended for the zeal manifested by them in looking out for the comfort and convenience of this body, and especially so in the introduction of the Edison electric light in this chamber. We find the chamber better lighted, the air less contaminated, and the heat less oppressive."

—— In the United States Court at New Orleans, the Brush Electric Light Company filed an application for an injunction restraining the Louisiana Electric Light and Power Company from using the automatic magnetic feed for carbons invented by Chas. F. Brush, but which the Louisiana Company are using in lamps purchased by them from the Jenny Electric Light Company. The application is also for damages for infringements on Brush patents.

—— The contract which the City of Brooklyn made with the electric lighting companies goes into effect this week, and, therefore, there will be very few gas jets burning in the streets. In the Western District of the city there will be 100 electric lights in place of 852 gas jets, and in the Eastern District 151 electric lights in place of 955 gas lights. The lights furnished by all these electric lights will equal that of 316,000 candles. The light furnished by the gas jets that are to be discontinued equal that of 44,567 candles.

—— In Paris it has been decided to light the Eldorado Cafe, Boulevard de Strasbourg, by electricity. The lighting will be carried out by 25 to 30 Cance arc lamps and from 35 to 70 Edison incandescents. An Olry and Granddemange engine of 40 horse-power, alimented by a Collet inexplosible boiler, will drive the dynamos, which are of the Gramme type, constructed by the firm of Ducommun, of Mulhouse. The work is to be finished and in order by the middle of next month. The management of the cafe have a very wise regard for the comfort of their clients during the hot summer months. The Casino de Bougival was lighted last week by 16 Jablochkoff lamps; and 20 lamps of the same system are installed at the Jardin de Paris in the Champs Elysees. These installations have been put down by the Societe l'Eclairage Electrique, who have employed the new Bobenrieth chandeliers to carry the lights.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING JUNE 30, 1885.

320,912 Protector for Electrical Instruments; David J. Cartwright, Revere, Mass.

320,921 Compound for Insulating Electric Wires; R. S. Ferguson, Waukegan, and Wm. Schumacher and Wm. Tubman, Chicago, Ill.

320,923 Individual Signaling Apparatus; Ellis F. Frost, Boston, Mass., assignor of one-half to Thos. W. Gleeson, same place.

320,975 Electro-Magnetic Escapement Apparatus for Printing Telegraphs; George B. Scott, Brooklyn, N. Y.

320,987 Method of Preventing Interference in Combined Telegraphic and Telephonic Systems; Francois Van Rysselberghe, Schaarbeck, Belgium.

320,997 Electric clock; Ferdinand Bauman, Waldenburg, Switzerland.

321,049 Electric Motor; John M. Pendleton, New York, N. Y., assignor to the Equitable Electric Co., same place.

321,057 Multiple Swichboard System; Chas. E. Scribner, Chicago, Ill., assignor to the Western Electric Co. same place.

321,058 Fire and Police Alarm Telegraph; Charles Selden, Baltimore, Md.

321,069 Electrical Registering Apparatus; Chas. W. Weiss, Brooklyn, assignor of one-half to Chas. Kruse, New York, N. Y.

321,073 Telegraphic Call Instrument; Frank B. Wood, New York, N.Y., assignor to the New Haven Clock Co , same place.

321,110 Method of Producing Electric Responding Signals; Alfred G. Holcombe, New York, N. Y., assignor to the Equitable Electric Company, same place.

321,147 Electro-Dynamic Motor; Frank J. Sprague, New York, N. Y., assignor to the Sprague Electric Railway and Motor Co.

321,148 Electro-Dynamic Motor; Frank J. Sprague, New York, N. Y., assignor to the Sprague Electric Railway and Motor Co.

321,149 Electric Railway System; Frank J. Sprague, New York, N. Y , assignor to the Sprague Electric Railway and Motor Co.

321,150 Electro-Dynamic Motor; Frank J. Sprague, New York, N. Y.

321,240 Joint for Electric Cable; Wm. R. Patterson, Chicago, Ill., assignor to the Western Electric Co., same place.

321,278 Exercising Machine; George P. Clarke and Gerard Harsin, New York, N. Y., assignors of one-third to Chas. E. Furman, same place.

321,285 Rheostat; John Doyle, Hoboken, N. J., assignor to himself and C. Coles Dusenbury, New York, N. Y.

321,309 Mould for Making Incandescents; Otto A. Moses, New York N. Y.

321,387 Combined Electrical Weighing Scale and Flour and Bran Packer; Chas. W. Roth, Evansville, Ind.

321,390 Duplicate Switchboard System for Telephones; Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Co., same place.

321,391 Multiple Switchboard for Telephone Exchanges; Charles E. Scribner, Chicago, Ill , assignor to the Western Electric Co., same place.

321,404 Means for Preventing Induction in Telephone and Telegraph Lines; Francois Van Rysselberghe, Schaarbeck, Belgium.

BUSINESS NOTICE.

ELECTRIC LIGHT COMPANIES, MANUFACTURERS OF ELECTRIC LIGHT APPARATUS, MACHINERY AND SUPPLIES, who desire to become members of the NATIONAL ELECTRIC LIGHT ASSOCIATION, must make application on or before August 1st, 1885. All communications addressed to J. F. MORRISON, PRESIDENT N. E. L. ASSOCIATION, BALTIMORE, MD., will receive prompt attention.

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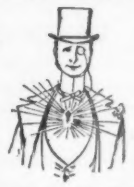

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Electrical Societies and what they are doing.—List of Electricians in N.A.—Foreign Electricians to whom U.S. Patents were issued during 1884.—List of Electric Light Companies in N. A.—List of Gas Companies in N. A.—List of Isolated Arc and Incandescent Plants in N.A.—Patent Statistics, Electrical.—Patentable Inventions.—Patents, Electrical, issued during 1884.—List of Manufacturers of Electric Light Apparatus.—Reports from Electric Light Companies.—Reports from Telegraph Companies.—Reports from Telephone Companies.—List of Telephone Exchange Managers.—Telephone Statistics from every Exchange in the U. S.—Appendix, containing fifty pages of interesting information relating to electricity.

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It is very nicely gotten up.—*Colorado Electric Co., Denver, Col.*

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It seems to be a valuable book.—*The Arnoux Electric Co., Wilmington, Del.*

We think it is what has been wanted.—*Holmes, Booth & Haydens, New York.*

It is a valuable publication.—*Salem Electric Lighting Co., Salem, Mass.*

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It is a valuable book and fills a want long felt.—*The Brush Electric Light Co., Buffalo, N. Y.*

It is a very useful and valuable book for reference and general information.—*Oskaloosa Gas Co., Oskaloosa, Iowa.*

It is filled with much new and useful information.—*Judge W. H. Moore, Huntsville, Ala.*

It is something that has been needed.—*Wells W. Leggett, Detroit, Mich.*

We are well pleased with it.—*Jarvis Engineering Co., Boston, Mass.*

We consider your publication a valuable one.—*The Edison Co. for Isolated Lighting, New York.*

We consider it a valuable book.—*The Minnesota Brush Electric Co., Minneapolis, Minn.*

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